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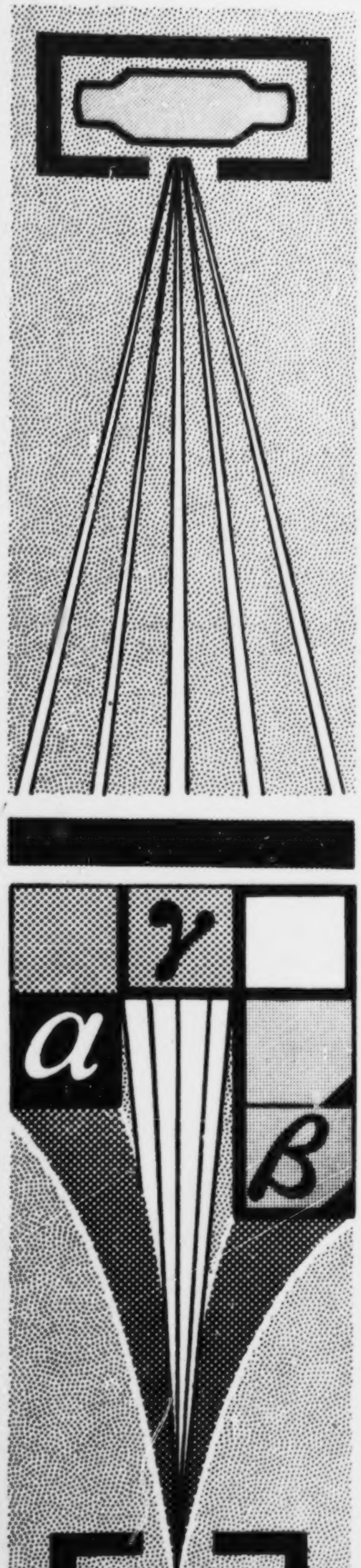

# SYMPOSIUM on PAST, PRESENT, and FUTURE STATE X-RAY PROGRAMS

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# SYMPOSIUM on PAST, PRESENT, and FUTURE STATE X-RAY PROGRAMS

May 21-22, 1968
Atlanta, Georgia

Edited by:

Robert G. Britain
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# FOREWORD

The Bureau of Radiological Health, formerly the National Center for Radiological Health, continues to carry out a national program designed to reduce the exposure of man to hazardous ionizing and non-ionizing radiation.

Within the Bureau, the Division of Medical Radiation Exposure deals with 1) the reduction of unproductive ionizing radiation exposure of patients, workers, and others exposed by the use of X-rays and other machine produced ionizing radiation, radioactive materials and radiopharmaceuticals, and 2) the improvement of radiological "systems" and methodology in the healing arts.

The Bureau publishes its findings in Radiological Health Data and Reports (a monthly publication), the Environmental Health Series, Public Health Service numbered reports, appropriate scientific journals, and Division technical reports.

The technical reports of the Division of Medical Radiation Exposure (DMRE), formerly the Medical and Occupational Radiation Program (MORP), allow comprehensive and rapid publishing of the results of intramural and contractor projects. The reports are distributed to State and local radiological health program personnel, Bureau technical staff, Bureau advisory committee members, university radiation safety officers, libraries and information services, industry, hospitals, laboratories, schools, the press, and other interested individuals. These reports are also included in the collections of the Library of Congress and the Clearinghouse for Federal Scientific and Technical Information.

I encourage the readers of these reports to inform the Bureau of any omissions or errors. Your additional comments or requests for further information are also solicited.

Raymond T. Moore

Raymond T. Moore, M.D.
Acting Bureau Director

# PREFACE

This publication contains the proceedings of a symposium on Past, Present, and Future State X-ray Programs held in Atlanta, Georgia, May 21-22, 1968. The symposium was cosponsored by the U.S. Public Health Service, Bureau of Radiological Health (Region IV Office and the Division of Medical Radiation Exposure), and the Georgia Department of Public Health.

The program was designed to promote a free exchange of opinion. Each subject commenced with a formal presentation followed with a discussion by the attendees. The three major problem areas that are contributing to the unnecessary population exposure that State radiological health programs must contend with are: (1) the continued use of X-ray equipment that does not meet accepted standards, (2) the use of equipment by operators who are not competent in the use of the more advanced techniques, and (3) the use of X-rays in an injudicious, repetitive and ineffective manner.

The objectives of the symposium were to examine critically State X-ray protection program concepts, goals, objectives, procedures, and methodology, and to determine the program components which should be modified, emphasized, created or eliminated for the States to meet most effectively the public health problems posed by unnecessary exposure of the general population to radiation from X-ray sources.

John C Villforth

John C. Villforth
Director, Division of Medical
Radiation Exposure

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## SUMMARY

### A. General Statement

The three major problem areas that are contributing to the unnecessary population exposure are: (a) the continued use of X-ray equipment that does not meet accepted standards; (b) the use of equipment by operators who are not competent in the use of the more advanced techniques; and (c) the use of X-rays in an injudicious, repetitive and ineffective manner.

### B. Initial Surveys

1. There has been a vast difference from State to State in regard to the type and depth of initial X-ray survey performed. The types of surveys have ranged from strictly equipment evaluations to educational surveys lasting several hours. To complicate matters, States have utilized different survey report forms which has made it difficult to compare the effectiveness of State programs.

2. The type of initial survey a State performs will depend to a great extent on the desired survey frequency, the manpower available to the program, and the presence or absence of regulations.

3. The deficiencies found during an X-ray survey should be explained in detail to the person in charge of the facility. This individual may be a hospital administrator, a radiologist or a general practitioner, and it is he who bears responsibility for the correction of defects noted in the survey report.

4. It has been suggested that the X-ray surveyor not operate X-ray equipment during a survey when there is a technician or physician available. Otherwise, he should obtain clearance from the person in charge of the facility.

5. The Public Health Service survey forms should be redesigned to include both PHS and State needs. The survey forms might, then, become more accepted and used more widely by the States. This would also be a step toward more uniform State X-ray surveys.

6. There are several items in State radiological health regulations that are being intentionally overlooked during the survey or exempted. They include, for example, an evaluation of timers on fluoroscopes and interlocks on certain therapy units. Consideration should be given to removing such items from the regulations and making them recommendations.

## C. Follow-up Surveys

1. There are basically two types of resurveys. One is a compliance check to determine if deficiencies noted in the initial survey have been corrected or if such items as filters and collimators may have been accidentally or deliberately removed. The other is essentially the same as an initial survey, but with more emphasis on educating the operator in X-ray safety techniques.

2. The frequency of resurvey should primarily depend on the workload of a facility. Hospitals and radiology clinics should be visited more often than the offices of general practitioners with very low workloads.

3. Some States have found that on resurvey of some facilities, recommended compliance procedures had not been instituted as was suggested by correspondence from the machine owner following the initial survey. This problem may be due to the types of replies that a State program has accepted from the registrant. It was suggested that this reply include how the registrant achieved compliance rather than a simple statement that he has complied.

## D. Regulations, Other Program Needs

1. An adequate data management system is of significant importance to a State program in the management of inspections and registrations and in the accumulation of data necessary to evaluate accomplishments and to determine areas of needed emphasis.

2. It was agreed that State radiological health regulations should be as firm as possible. However, it was also understood that no matter how stringent the regulations may be, allowances should always be made for professional judgement.

3. There is a lack of uniformity in State radiological health programs regarding what is to be considered "in compliance" and what is to be considered "deficient." It was suggested that a committee, comprised of representatives from the Bureau of Radiological Health and various State radiological health programs, be formed to evaluate these problems and make specific recommendations.

## E. Operators and Radiation Protection Practices

1. It was agreed that a State program should not attempt to supervise or police radiologic techniques used in the healing arts, but rather to work toward cooperation with schools of medicine and X-ray technology in the development of curricula that will include radiation safety instruction.

2. Two methods have been used in the past to improve X-ray operator understanding of radiation safety practices. One method has been to spend considerable time with the operator during an X-ray survey. While effective on a facility basis, this procedure tends to lower the efficiency of the survey program. Another method has been to offer short courses for X-ray technicians. This activity has proved effective on a group basis but has the disadvantage of failing to reach those operators with little or no training, the individuals who could most benefit by it.

3. One method of assuring that operators meet minimum qualifications is through licensure. This requirement is not meant to burden or upgrade the already proficient X-ray technician, but merely to eliminate the unqualified. Licensure could be structured so that an operator specializing in a single technique would not have to meet the same requirements as an individual performing many techniques.

## F. Surveyor Qualifications

1. There are two schools of thought regarding X-ray surveyor qualifications. Those individuals who perform only equipment surveys or compliance checks can possibly function with a minimum in radiological health training. Possibly two PHS training courses would be adequate. Those individuals who perform more comprehensive surveys and become involved in the educational aspects of radiological health should have much more training. It has been suggested that a B.S. in one of the physical sciences, plus extensive training in radiological health, be required.

2. Due to the rapid advances in the design of X-ray equipment and accessories and new philosophies in X-ray techniques, State personnel should attempt to keep abreast of new developments. It has been suggested that a simple communications system be developed within the State radiological health programs as a means of keeping personnel informed of recent developments.

# SYMPOSIUM ON PAST, PRESENT, AND FUTURE STATE X-RAY PROGRAMS

## INTRODUCTORY REMARKS

The Symposium on State X-ray Programs - Past, Present, and Future convened in The Green Room of the Downtown Holiday Inn, Atlanta, Georgia, Tuesday morning, May 21, 1968, and was called to order at 9:10 o'clock a.m. by Mr. Richard Fetz.

MR. FETZ: I would like to introduce myself to those I haven't had an opportunity to meet. I'm Dick Fetz, Director of the Radiological Health Service, Georgia Department of Public Health. We welcome you to Atlanta. We hope that you have a profitable two days with us. For the benefit of those who haven't had an opportunity to attend a seminar of this type, let us say that it is a free-swinging, no-holds-barred sort of affair. At this time, I'm going to turn the meeting over to Mr. Payne.

MR. PAYNE: The first item on the program has to do with the extent of the X-ray problem. This is on a national basis. Therefore, we have asked people with national experience to handle this subject. The first speaker is Dr. Richard McDowell.

# EXTENT OF THE PROBLEM: X-RAYS IN THE HEALING ARTS

Richard B. McDowell, D.D.S., M.P.H.[1]

I would like to give you what I feel is basically the situation regarding the status of the use of X-rays within the healing arts. The estimated 210,000 X-ray units used in the healing arts constitute one of the major man-made sources of radiation exposure to the general population in existence today. Presently, more than one-half of the United States population undergoes a diagnostic X-ray procedure yearly. The 1964 Public Health Service survey estimated that there were over 143 million X-ray visits yearly -- 50 million dental, and 93 million medical. Involved in these visits were an estimated 506 million films or exposures. From these data, one can appreciate the potential magnitude of the use of X-ray by practitioners of the healing arts. If one were asked to identify the three major problem areas that are contributing to the unnecessary population exposure, they would undoubtedly be: (1) the continued use of X-ray equipment that does not meet accepted recommended standards; (2) the use of equipment by operators who are not competent in the use of the more advanced techniques; and (3) the use of X-rays in an injudicious, repetitive, and ineffective manner.

It is our opinion that considerable progress has been made during the past few years toward reducing unnecessary population exposure. For example, in terms of man-year equivalents (full and part-time) devoted to State X-ray survey and control, 74.1 was the figure reported at the end of fiscal year 1962; whereas by 1966, a 110 percent increase to 155 man-year equivalents of State personnel was reported to be engaged in X-ray survey and control activity. During this same time period, the number of States having regulatory or compliance-type programs progressively increased to the point that by the end of fiscal year 1967, 26 of the 53 State X-ray programs were classified as being regulatory in nature. The remaining were either voluntary or a combination of voluntary and regulatory. This progress is significant in light of the recommendations contained in the March 1959 report to the Surgeon General prepared by the National Advisory Committee on Radiation Protection entitled The Control of Radiation Hazards in the United States, which states:

> "... extensive studies have revealed that most of the ionizing radiation received by the population today, other than that received from natural sources, has been from the X-ray machines employed by the health professions.
>
> "Concerted effort is now being applied by these professions to reduce, as far as is possible, the exposure of individuals undergoing X-ray diagnosis and treatment."

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[1] Chief, Radiation Machines and Applications Branch, Division of Medical Radiation Exposure, Bureau of Radiological Health, Public Health Service.

> "Even so, the absence of a comprehensive program through which the health hazards of all sources of ionizing radiation may be brought under supervision appears to this committee to be an important weakness in this Nation's efforts to control radiation safety."

The major advances are most notably demonstrated in the first problem area, namely, the continued use of X-ray equipment that does not meet recommended standards. For example, if one reviews the results of dental surveys conducted prior to 1960, it is revealed that approximately 60 percent to 80 percent of the units did not meet the recommended standards for filtration and collimation as proposed by the NCRP. Today, however, we can reasonably estimate that greater than 80 percent of the 100,000 dental X-ray machines in the United States now meet minimal standards for filtration and collimation.

Unfortunately, progress in the correction of deficiencies in medical or medical-type installations has not been as dramatic as that experienced in the correction of dental X-ray machine deficiencies. In part, this was due to the ease in which the dental X-ray machines were corrected and to a delayed interest in medical X-ray surveys on the part of most States.

In 1963, the various reporting agencies estimated that there were between 100,000 and 125,000 medical X-ray machines in this country, of which approximately 45,000 had been inspected or surveyed at least once. Of that number, it was reported that 50 percent to 90 percent of the machines surveyed did not meet minimal State recommendations or standards. By June 30, 1967, approximately 48,000 of the estimated 112,000 medical X-ray machines currently in use by nonfederal practitioners in the healing arts were reported to meet current State recommendations or regulations. Thus, one has to conclude that considerable effort will be necessary to bring the remaining medical X-ray installations up to minimal standards.

Once a reasonable compliance percentage is assured, increased emphasis can and should be placed on improving the qualifications of the operators and on the efficient, effective, and judicious use of the equipment. The potential audience for this effort involves approximately 400,000 practitioners in the healing arts and an estimated 300,000 X-ray machine operators.

## X-ray Equipment

Now, let us look at the first problem area -- the continued use of X-ray equipment that does not meet recommendations or standards. By the end of fiscal year 1967, only 26 of the 53 radiological health programs had reasonably rigid equipment regulations. In general, the majority followed the recommendations of Handbook 76 (NCRP), or the regulations proposed by the Council of State Governments. Unfortunately, there does not appear to be a uniform or reasonably uniform interpretation of these recommendations or standards. In part, this can be attributed to the various program philosophies, the lack of standardization of surveyors and/or survey techniques, inexperience on the part of the surveyor, and the use of recommendations that are not current with respect to those presently proposed by the NCRP or the Council of State Governments. In addition, there is a reluctance on the part of some State program directors to investigate areas outside those specified by their rules or regulations.

The early activities of the National Center for Radiological Health with respect to equipment standards were largely concerned with the development and support of State X-ray programs by direct financial and technical assistance. Technical assistance included the provision of filters and collimators, Surpaks[1] and survey kits for equipment surveys, training of equipment surveyors, and consultation, including the direct assignment of personnel to State programs.

When Public Law 89-749 became effective in July 1966, it forced a change in the mechanism for supporting State X-ray activities. This was largely due to the change in funding at the Federal level for State health and health-related programs. Under this law, the States are given a single health service grant, and the individual State programs compete for these funds on the basis of their individual program's merit and need. Since direct Federal Financial support is no longer available to the individual programs through categorical formula grants, a decrease in State X-ray activities could occur. If this happens, what alternatives should be considered to achieve compliance with minimal machine standards throughout the United States?

In order to achieve the goal of obtaining the maximum amount of information per unit of radiation exposure, increased emphasis will have to be directed to the areas of technique and judgment. This assumes a continued effort on the correction of machine deficiencies.

## Operators

The second major problem area is the use of equipment by operators who are not competent in the use of the more advanced techniques. In this area we can identify such factors as the proper selection of patient position and machine settings, the proper use of high-speed film if indicated, to achieve the maximum amount of diagnostic information per unit of radiation exposure, the proper development of film including darkroom management, and the adherence to current acceptable radiation reduction practices consistent with present-day knowledge and experience. The ultimate solution to this problem will be obtained only when all those who operate X-ray equipment employ the most efficient techniques, thus attaining the optimum clinical result per unit of radiation exposure for both the patient and the operator. But what should be the minimum qualifications for X-ray machine operators? This question alone promotes considerable discussion when one considers factors such as, "Is it necessary for an operator using an X-ray machine for a single purpose to have the same qualifications as one who is involved in performing many varying types of examinations on a multipurpose machine?" Perhaps the introduction and widespread use of single-purpose machines will help to answer this particular question.

---

[1] "The Dental Surpak Survey Method," Radiological Health Data, January 1963.

New York State, for example, requires the licensing of machine operators for all procedures except those related to dentistry, in which case the beam must be limited to an area no greater than three inches at the patient's face. Oregon, on the other hand, requires a Certificate of Radiological Proficiency for all dental assistants who operate X-ray machines. Yet, there is no provision in the Oregon law for the licensing of operators of medical-type equipment. Therefore, if one were to establish categories for operators, what criteria should be used for each category? Is it necessary for the operator to be a graduate of an accredited school or are there other criteria that need to be defined to determine operator qualification?

A study conducted by the Division of Radiological Health in 1966 showed that approximately 95 percent of the part-time nonregistered operators had no formal X-ray training whatsoever, and that 86 percent of this group were employed in private offices and clinics. Although their work load was relatively low when compared with the registered operators, this group represents about one-half of the machine operators in medicine, excluding the licensed practitioner.

To eliminate this situation, we feel that a minimum standard of experience and training should be established for all operators of X-ray equipment. Once this is a reality, training materials and standardization of course material applicable to X-ray protection practices within the various healing arts professions can and should be developed and used to promote a standard curriculum so that a minimum knowledge requirement will be possessed by all X-ray machine operators.

To be assured that minimal qualifications are maintained by the operators of X-ray equipment, should not a periodic examination process be instituted, and, if it is determined that this is necessary, at what frequency should the examination be given? Should this be a uniform examination for all X-ray machine operators in the United States or should this be left to the respective political jurisdictions? In any case, we must be certain that the operators of the units are competent and are using the most advanced techniques available so as to insure the maximum amount of benefit per unit of radiation exposure.

## Judicious Use

The last problem area that has been identified, perhaps will prove the most difficult to solve. This is the judgment area involving the decision to use X-ray for diagnostic and therapeutic purposes. The prime target group in this instance is the practitioners, including those in voluntary and governmental public health agencies, who are responsible for determining whether a specific procedure should be conducted in order to promote the health of the individual patient or group of patients. For example, one frequently sees repeated mass chest X-ray screening techniques used in geographic areas where the incidence of new cases of active disease, for example, tuberculosis is traditionally low.

To influence the judgment of the practitioner will not necessarily mean an overall reduction of radiation exposure, but rather it will help assure that the greatest diagnostic or therapeutic benefit is obtained from the specific procedure or examination. If one orders a particular X-ray procedure, one must assure himself that it is: (1) necessary, and (2) done under optimal conditions prevalent to that particular examination.

How do we go about solving this problem? It would seem that two or three solutions could be identified. Perhaps the most obvious is to introduce into the educational process of preprofessional graduates the philosophy regarding the benefit/risk criteria involved with the use of X-ray. Yet, we are constantly faced with the increasing demands upon the student's time with everyone considering his particular program or academic endeavor more beneficial than another's. For this reason, it would seem appropriate that questions relating to acceptable radiation protection practices should be incorporated as a part of all State or national board examinations. If this is done, it will force the respective schools to consider this topic as part of their normal curriculum.

Another area that deserves attention is the education of practitioners who are currently using X-ray as part of their practice. How does one go about educating an audience who are uninformed, disinterested, and/or resistent to change? Is it through the development and promotion of programmed instruction courses and audiovisual materials, the adoption of peridoic examination processes as proposed recently by a Presidential commission, use of professional literature, or through the operator of the respective X-ray machine?

It is quite possible that the ultimate solution to this particular problem will be the operator of the X-ray machine; for if adequate experience, training, and/or qualifications are required in order to operate an X-ray machine, the result should be the utilization of good radiological health practices or radiation reduction techniques. For this reason, it would seem that the education of the respective practitioners might be and could be intimately tied to the actions of the respective X-ray operator.

Regardless of what decision is made with respect to any specific question or problem previously discussed, the solution to the three major problem areas promises to be a tremendous challenge if we are to assure ourselves that: (1) the most advanced techniques are employed by competent operators; (2) equipment meets recommended standards; and (3) when X-ray is used or ordered by a practitioner in the healing arts, it is used efficiently, effectively, and judiciously, so that the maximum diagnostic benefit is available to all with a minimum of radiation exposure.

## Discussion

Mr. Little: You have referred to operators throughout your talk on several occasions. You were speaking of technologists, were you not, not physician operators?

Dr. McDowell: Any person that activates the unit, which could be a practitioner, versus a so-called X-ray technician or X-ray technologist, is considered an operator.

# HISTORY OF STATE X-RAY PROGRAMS

Marshall S. Little, M.S.[1]

## Shoe Fitting Fluoroscopy

The first big impetus to State program development occurred around 1947 as a result of concern over the shoe-fitting fluoroscope. The man who deserves some of the credit for the initial investigations into the hazards of the shoe-fitting fluoroscope was Mr. Pete Valaer with the Bureau of Radiological Health. In 1947, Mr. Valaer was an Industrial Hygiene Engineer with the D.C. Department of Public Health. He became interested in this radiation source and after making several surveys in the Washington area, he gave several seminars on his findings. A national magazine carried a story of Mr. Valaer's findings, which may have caused subsequent stories to appear in newspapers across the country. This resulted in enough interest in X-ray control to bring about the creation of several State programs to investigate problems of X-ray exposure. (It is of interest to note, however, that today there are still 18 States that have taken no action to eliminate the shoe-fitting fluoroscope.)

## Federal Grants for Radiological Health

The second major stimulation of State radiological health programs occurred around 1963. By this time there was considerable public apprehension over nuclear weapons testing. As a primary result of this concern, Congress established the Public Health Service categorical grant in radiological health. This was a grant to States based upon a formula which took into account the population of the State and the number of radiation sources. These funds allocated on a matching basis, had an immediate effect in stimulating radiation control throughout the nation. In 1963, the first year of the grant, the amount of funds expended in radiological health by State agencies increased 65 percent over the previous year. Most of this increased outlay went for equipment and personnel to set up State laboratories for measuring radioactivity in the environment. Unfortunately, only 38 percent of the funds were used in the X-ray control phase of the programs. In subsequent years funds expended in X-ray control increased annually through fiscal year 1966, but even with increased expenditures, in the period immediately following the initiation of the Federal grant program, there was little progress made in reducing exposure.

The principal difficulty at the operational or State level seemed to be the question of how to begin controlling the use of X-rays in the healing arts, since for so many years there had been virtually no policing of any kind. Also there were very few individuals with the professional training necessary for the conduct of such a program. This impasse was overcome in large part by two major developments: First, the Public Health Service loaned the States equipment and trained personnel. The personnel were assigned to the States for periods of one to two years. Such assignments offered mutual benefits. The Public Health Service was given the opportunity of collecting information useful to other States in developing programs, and also of further defining the national problem. For the States, an assignee provided a technically well-trained man who could determine the extent of the problem at the State level, and who could demonstrate the effectiveness of pilot projects to reduce exposure.

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[1] Chief, Division of Radiological Health, District of Columbia Department of Health.

## Dental Surpak

The other major development in initiating State X-ray control programs came about primarily as a result of one man and one technique. The man was Dr. George Crocker of the Public Health Service and the technique was the dental Surpak. This technique, devised by Dr. Crocker and made available through the National Center for Radiological Health was designed as a mail-order evaluation of a dental facility. It consisted of a package containing a piece of 8- by 10-inch X-ray film with an aluminum step wedge. The dentist, on receipt of the package, was to record certain exposure factors, such as kVp and mA, and then to expose the film with the tube pointed toward the center of the package. It was mailed to the dentist by the State agency, then returned through the State to the National Center for Radiological Health for processing.

Of course the technique had many problems. Frequently, the dentist failed to understand the instructions, or he would treat the package as an advertisement and throw it away, or it might be placed near the X-ray machine and be exposed to scattered radiation. In some States, when the total cost of a Surpak survey was compared with the cost of on-site inspections, it was revealed that an on-site survey might be considerably less expensive, except for the dentist located in remote rural areas. On the other side of the coin, a great number of machines having improper collimation and filtration were corrected as a result of this new method. But the most important benefit was the fact that the State and metropolitan health departments had, at last, begun a corrective program in radiological health. Working relationships were being established with X-ray users, methods were being tested, and reputations and experience were being developed which would prove useful in many areas of the program.

## State Progress

In the meanwhile, the training of physicists, chemists, engineers, pharmacists, health educators, and administrators for health departments had been greatly accelerated, and this training also began to improve the effectiveness of State programs. Several States began to make progress - even with medical users. Those States which evidenced most progress, however, were the ones which had gained experience with dental X-ray facilities, and programs which had developed good rapport with the professional societies. Generally, this rapport was developed through professional advisory committees to the controlling State agencies. It is unfortunate that in some States, these committees have been allowed to become inactive. I consider this unfortunate because in the approaching phase of X-ray control in which we are going to become more involved in techniques, judgements, and program evaluation, we are going to need these committees more than ever before. Today in the majority of States, surveys of dental and medical X-ray installations have been completed. In some programs, enough repeat inspections have been made to qualitatively appraise the effectiveness of the inspections in correcting deficiencies. One noteworthy feature of most of these State inspections is that they are generally directed toward deficiencies in the machine or the physical plant, such as collimation of beam, filtration, timers, protective booths. A number of States have enacted regulations for the control of these equipment deficiencies. I am sure this has brought about significant progress in reducing public exposure.

But how do we measure progress in a State radiological health program? What is a deficient facility? Is it possible to arrive at a uniform definition? And what has been done to correct problems of dark rooms and film processing? We all know that the method of development will have a great bearing on the degree of exposure. Also many medical and dental X-ray facilities are still using slow-speed film requiring five to ten times more radiation than faster speed films. What about the hazards associated with special medical procedures not under the direction of a radiologist, for example, the urologist and cardiologist? In the District of Columbia we have documented examples where fluoroscopic exposures as long as 90 minutes have been used on a single patient. Such long examination times are not uncommon when the cardiologist is untrained in fluoroscopy and/or not knowledgeable of the roentgen output of his machine. Other common techniques, such as holding of patients or film during X-ray examinations, use of exposure factors in routine radiology which are related to skin color, and failure to balance risk against benefit in mass X-ray screening programs, need further controls.

## Education

Let us look at the progress, or the lack thereof, in the area of radiological health education of both the user and the general public. Most of the State-sponsored seminars, short-term courses, and "road shows" have been aimed primarily at the dentists. Only in the past year or so has there been some shift in emphasis from the dentists to the X-ray technicians. There has been a notable lack of training offered for the physicians, the industrial users, the service technicians, and the sales representatives of X-ray equipment. There also appears to be a need for more education directed toward the general public. Should not the control agencies do more to counteract the public's fear of X-ray exposure?

If this fear could be changed to enlightened respect, would it not have the effect of increasing the benefits from radiation? As I see it, the control agency has a responsibility to both reduce exposure and support the beneficial uses of radiation. For many years we have given attention to the exposure without balancing our considerations by equal attention on the benefits. This balance is essential to a good program.

## Conclusion

In conclusion, the State and Federal radiological health programs deserve praise for significant progress in correcting equipment deficiencies, design of shielding for radiation facilities, and in developing uniform standards that have led to uniformity of regulations in over twenty States. Good training programs have been made available to dentists and X-ray technicians, and mutual respect has been established between control programs of most States and the professional radiation users. The weaknesses of such radiological health programs include inadequate attention to technique deficiencies, unsatisfactory methods of program evaluation, and inadequate evaluation methods for special radiology procedures. There is continued use of slow-speed lens systems on mass screening equipment, and improper use of high speed film. Education programs are badly needed for practicing physicians, podiatrists, chiropractors, and even the general public. Particular effort should be made to promote more radiation protection training in medical and dental schools.

## CURRENT STATUS OF STATE X-RAY PROGRAMS

MR. PAYNE: You have heard about the extent of the problem of X-ray in the healing arts. We will now have status reports on various State X-ray programs by those present from the States represented here.

### Region IV - H. Richard Payne[1]

The Region IV X-ray programs began as early as 1947, long before there were any official radiological health organizations. These were operated primarily out of the State industrial hygiene sections and included inspections of shoe-fitting fluoroscopes and surveys of medical X-ray units upon request. From 1958 to 1961, the States came to recognize the need for bona fide radiological health programs and established same. Some of the initial activities consisted of supplying collimators and filters to dentists on a voluntary basis, conducting X-ray surveys upon requests from county medical societies, and conducting X-rays based upon a planned development by the State health department.

Since 1958, State X-ray programs in Region IV have evolved to include: a registration of X-ray machines; State-wide physical surveys of dental, medical, chiropractic and veterinarian X-ray units; as well as resurveys or compliance-type surveys on dental and medical units; dental and medical Surpak surveys; and promulgation of specific regulations.

Four of our Region IV States now have regulations and the other two are developing regulations. All are conducting educational programs for technicians and professional personnel.

The Region IV States are primarily concerned with the following four objectives: (1) To reduce the exposure to ionizing radiation of the general population in the State as much as possible, consistent with good medical practice and judgment; (2) To continue X-ray machine survey programs until all have been surveyed and resurveyed as required; (3) To maintain a current registration of X-ray tube heads and other X-ray-producing machines in the State; and (4) To inform physicians, dentists, technicians, and all X-ray machine users concerning radiation protection through explanation, demonstration and evaluation -- in other words, educational programs.

Currently, 85 percent of the dental units and 60 percent of the medical machines have been inspected at least once within the six States in the Region. Approximately 20,000 physical inspections have been performed over the years, and currently, 90 percent of the dental machines inspected and 70 percent of the medical machines inspected are in compliance with State regulations or recognized standards.

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[1] Regional Representative, Region IV, Bureau of Radiological Health, Public Health Service.

## Mississippi - Eddie S. Fuente and Charles E. Hilton[1]

The Mississippi program was initiated early in 1960 on a voluntary basis with the dentists and the physicians. We have conducted four or five surveys or resurveys strictly on the physical plant. Occasionally, we will go into the darkroom, but we have not been concerned with technique. We have brought into compliance probably 85 or 90 percent of our medical units.

In conducting resurveys the inspector often found the same discrepancy as noted in earlier surveys. So last year we decided on a new approach. Rather than recommending to the radiologist or the hospital administrator that the discrepancy be corrected, we decided to write letters that required either the radiologist or the hospital administrator to notify us within 30 days of what corrective action they were going to take. This has proven very satisfactory.

We found that the vast majority of our X-rays were taken in hospitals and large clinics which amounted to about 87 percent of the films taken. By concentrating on this group, initially, we were able to get a large compliance rate per films taken. Later we inspected the small practitioners - those who are taking eight or ten films a month.

## Kentucky - Richard M. Fry, M.S.P.H.[2]

Fortunately, Kentucky started out by the top administrator demanding the setup of a radiological health unit, rather than the health department demanding such a program. It was the Governor's office who said, "We want it done," It was the professional societies who said, "We want it done."

From the beginning, on the bottom of every survey results sheet a space was provided for the radiation user to sign which indicated that he would correct any deficiencies within 60 days. You may say that, "You must be a mad police State." This is not true but there has to be more than just a voluntary program.

## Pennsylvania - Joel O. Lubenau, M.S.[3]

In 1956, we were fortunate enough to have a regulation for radiation protection promulgated; a registration program was begun and a health physicist was brought in. Up to that time, the program had been conducted by the industrial hygienist engineers.

We now have inspected 95 percent of our dental units, and they are in compliance. We have about a 95 percent level for inspection of the remaining 9,000 users in the State. We are in a resurvey program at the present time.

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[1] Supervisor and Health Physicist, respectively, Radiological Health Unit, Mississippi State Board of Health.

[2] Director, Radiological Health Program, Kentucky State Department of Health.

[3] Radiation Health Physicist, Pennsylvania Department of Health.

## North Carolina - Dayne H. Brown, M.S.[1]

North Carolina has a program similar to Kentucky. We have been requiring 30-day correction of any noncompliances with our regulations and have a mandatory registration program. Currently, approximately 3,000 machines are registered. One problem is that there are a lot of machines that have gone undetected. The radiation users are not aware of all the facts pertaining to our regulations and a lot of them don't know that X-ray machines have to be registered.

We have an active inspection program and are trying to inspect all the machines in the State. There is not a great deal of work that has been done along the inspection line and we are hopeful that in the next two years all registered machines will be inspected.

When our regulations were adopted, all hospital X-ray machines were exempted from our regulations and our jurisdiction. I find it rather difficult to get terribly excited about going after these 3,000 X-ray machines which represent about 20 percent of the problem. One of my long-range objectives is to bind a way to survey the hospitals. I can get invited by the hospital to conduct a survey, and the Medical Care Commission will accept our surveys as those that are required periodically, but I can't very well do this on a grand basis until I have cleaned up what I do have jurisdiction over.

## Alabama - William T. Willis, M.S.[2]

In Alabama, we started in 1963 with a voluntary dental survey. During surveys of these dental units, filtration and collimation were added. This survey program included Jefferson County, which had its own program prior to the time that the State program was set up.

In 1965, the State Board of Public Health adopted the rules and regulations concerning the use of X-ray equipment. Consequently, since that time we have had more than just a survey program going on. The first medical survey was conducted in 1964, and the second survey was conducted in 1966. I should say, the initial inspection was conducted at this time, because I think that once you get regulations and power to enforce them, you move from a survey type of program into an inspection type of program.

Since that time, we have been writing letters citing items of noncompliance. We have not specified 30 or 60 days, but we have followed up on it. So at the present time, in excess of 95 percent of all X-ray units in the State of Alabama -- this includes dental, medical, chiropratic or any other type of X-ray -- are in compliance with the State regulations.

We are at the point of getting into the educational phases, that is, the qualifications of the operators of the units, the development techniques, the use of slow or fast film, and this type of operation.

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[1] Director, Radiation Protection Program, North Carolina State Board of Health.
[2] Chief, Division of Radiological Health, Alabama State Department of Public Health.

## New Jersey - LaVert C. Seabron, M.S.[1]

The New Jersey program got started around 1959, with the enactment of the New Jersey Radiation Protection Code. Our first problem was to locate all the units in the State. By 1966, we had registered 10,000 X-ray machines of all types, scattered throughout the 21 counties in the State.

We ran into all the problems that have been so far discussed, the main one being how do you get people to comply. We developed good rapport with the consultants from the professional societies to the New Jersey Commission on Radiation Protection. In spite of this relationship with the consultants it was in dealing with the individual doctor, how our inspectors approached and handled the individual cases, that determined whether or not our program was going to be effective.

We set out to do initial inspections on all the units in the State. We had geography problems. We had personnel problems. One question was, could we hire nondegree-type people. Through trial and error, we had decided that degree-type individuals worked out best in this area, because of the "diplomacy" required to work with the members of the healing arts. More recently, associate degree have been instituted and this category of inspectors may well prove to be best.

We adopted a formal inspection program with a follow-up activity, which we found was another big factor in the program's effectiveness. We found that a strong follow-up program established a feeling in the healing arts community that the State was really interested in getting these things corrected. We further showed our interest by promptly coming back when we had been notified that the corrections had been completed, at which time we verified that the corrections were completed and that they actually were what the State wanted.

These are the types of problems that we ran into: What do you do when you have inspected 10,000 machines? How do you establish a resurvey priority? How do you decide what unit should be looked at and at what frequency? This meant that our whole inspection procedure had to be looked at again. As we inspected units we adapted our findings to ADP, so that for budget purposes we could project ahead 5 years to know what our case load was going to be, and this in turn would project our manpower requirements and our budget requirements.

## Tennessee - J. A. Bill Graham, M.S.S.[2]

We have been in the program since 1959, and since then we have made a lot of mistakes. I think the greatest mistake we made was in the response that we requested of the recipient of our program. In the beginning, we prepared a slip which stated, "I have read your recommendations, and I have complied." This slip was to be signed by the physician or dentist and returned to us. The Surpak methods provided a good way for us to check without having to go back to see if these people had actually complied as they had said. At least we could find out whether they had put in the filters and collimators. We found that about 90 to 95 percent of these people had not put in filters or collimators.

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[1] Formerly with the New Jersey State Department of Health. Presently with the PHS Bureau of Radiological Health.

[2] Assistant Director, Radiological Health Service, Tennessee State Department of Public Health.

Today, we are handling our X-ray inspections in the same manner as we handled our isotope inspections. We made an inspection and notify the facility by letter of the specific recommendations or requirements. We ask the facility for their reply within 15 days, as required in the code.

### South Carolina - William G. Crosby, M.P.H.[1]

I would like to make one comment. I know that regulatory practices on the machines themselves must be necessary, and I am sure that everyone will ultimately get around to it if they haven't already, but I can't really get excited, because what Dr. McDowell and Mr. Little said this morning is really getting to the meat of it, and this is the practice that is exercised now in the use of X-rays. I would like to try to by-pass some of these physical surveys and spend my money more judiciously, but I don't know how to do it. That's what I came here to learn.

### Jefferson County, Alabama - C. Barry Robinson[2]

In 1961, when the Jefferson County Medical Society actually requested that the Board of Health initiate a program, we had a good relationship with the physicians and dentists indirectly. When we started, the Board of Health recommended that we judiciously pick an advisory board made up of radiologists and physicians. This we did, and have had essentially no problems with the healing arts people in the control of X-rays in Jefferson County since the beginning.

Within the next few months, we will have surveyed all the X-ray units that were in existence when the regulations were written, at least three times.

### Georgia - Richard H. Fetz, M.S.[3]

We have been in the business for a bit longer than some of the people represented here, having done our initial radium survey in 1943, and really gotten started in the X-ray area about 1948. However, we seem to be dragging our feet more than anyone else. Every time I see Dr. Howard McMartin, he always asks why we aren't doing anything in X-ray. This is partially the reason we're here today, because we are trying to define in our own minds what we are supposed to be doing.

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[1] Chief, Radiological and Air Pollution Sections, South Carolina State Board of Health.

[2] Radiological Health Supervisor, Jefferson County Department of Health.

[3] Director, Radiological Health Service, Georgia Department of Public Health.

We do perform surveys. We don't have a formal registration program. We don't have actual rules and regulations as of today, but we are spending a lot of time in X-ray management through the good offices of Mr. Karp.

## INITIAL SURVEYS OF X-RAY FACILITIES

**MR. PAYNE:** Our next topic will cover initial X-ray surveys. We shall endeavor to determine what constitutes a satisfactory initial X-ray survey. Three points of view will be presented. Representing a State viewpoint will be Mr. Richard Fry; a private consultant's viewpoint, Mr. Randy Carter; and the Federal viewpoint, Dr. James Miller.

### A State Viewpoint - Richard M. Fry, M.S.P.H.

Initial surveys should certainly be tempered with why the program exists. If you're there at the good graces of an encouragement from a State medical society, or if you are there from a regulatory standpoint of being appointed, hired with a set of regulations placed in your lap, your initial surveys have a different flavor to them, both roles -- of a voluntary and regulatory type program with definite advantages in both programs.

Suffice it to say, Kentucky started out with a full set of regulations, but the idea has not been one of inspection. I will take exception with someone that says surveys turn into inspections when you adopt regulations. There is more to it than not using the word "inspection." It is the concept of providing a service. Yes, there is behind the regulations a provision for a maximum penalty of five thousand dollars a day if you refuse to accept this service, and that makes the offer of the service a little more flavorful, but nevertheless, if you sell it from the standpoint, "If you don't let me in here, I'll fine you for it," you have lost the battle before you start.

These initial surveys have to be done with the cooperation of the communities involved, and I mean the total community. I think it is important that an X-ray program be comprehensive - that it covers all X-ray users. This is one of the reasons why I like the approach of going into an area and surveying all types of facilities in that area versus the concept of going in and seeing first the dentists, then the physicians, and then the hospitals, or whichever order you select. I realize that you have to establish priorities, but the objective of this initial survey is one of introducing yourself, your program, and radiation safety.

I think one drawback of a voluntary-type request program would be the difficulty of coordinating the travel and getting into the area. In a random survey program you survey one facility because you were requested, but not the one next door. It would not be at all profitable to conduct such a request type program in Kentucky, where there is considerable travel associated with our surveys. Therefore, we have used the area-type approach in Kentucky.

Our initial surveys were equipment standard-type surveys. We were introducing ourselves, looking at the workload on this equipment, determining what it was being used for, and establishing basic equipment standards. At one stage, our survey record forms were as small as a 5- by 7-inch card. We could do a combination survey by putting the radiographic information on one side and the fluoroscopic information on the back side of the same 5- by 7-inch card.

At that very first survey, we did a lot of educational work. We distributed radiation safety literature and we became active in an educational program through the various professional conventions. This year we are going to try some public radiation safety education with the State fair.

The initial surveys when measured against our program standards of today were marginal in light of what we call a survey now. If we had to do them over, we would pick out, as we did then, the major points of what we were trying to get across: filtration and collimation for the equipment, and care on the part of the operator. I feel strongly that a surveyor cannot go in and tell the man that 50 things need to be fixed. If there are certain major corrections, these are appropriate things to be cited in initial surveys.

It is important to leave a written report with the individual. You may do this with a letter back to them, as some of the States do. We have elected to use a form-type report which we can leave with them at the end of our survey. This saves a lot of secretarial work.

As part of our initial survey, we are primarily concerned with the operator and the scattered exposure levels measured around the area where the operators stand.

Personally, I believe that an initial survey should not be a comprehensive complete overview of the equipment, operator, and medical judgment. These are parts of a total program - a total survey activity. I don't see how they can be incorporated into an initial survey. Part of the problem is time. The other problem is expecting an individual radiation user to absorb all these standards and guides.

I would encourage you to pick out no more than a half-dozen major things you want to do in an initial survey. If it's to do with the operator's qualifications, then stress that. If you want to pick out two or three equipment standards that you want to stress, this is all right. Personally, I would look at filtration and collimation - these are the two things that have been proved from the beginning to reduce significantly patient exposure - and then discuss with the operator good safety techniques.

We have always made it part of the initial survey to discuss our results, not only with the user, the physician, the industrial plant manager, but also to discuss these results with the overall management of the radiation facility.

Discussion (entire group)

**MR. KARP:** I disagree with you. I think the initial survey really should give you enough information to define a problem. When this is done, you can go back on your resurveys and concentrate your efforts on these problem areas. Unless you do a complete survey, you won't know what you're looking for. Each time you go for a resurvey, you will be looking for something else. The first survey determines the basis for your resurvey. You say that time is a problem on a first survey. I don't believe this is the case. I think you can spend enough time, three or four hours if you have to, with some people, then you can eliminate a number of follow-up surveys.

**MR. FUENTE:** When you're speaking of three or four hours, this is a long time to spend. I think it is somewhere in the neighborhood of 45 minutes to an hour, unless you're surveying a number of X-ray units in one facility.

**MR. KARP:** We will spend two or three hours with one chiropractor. We spent the time and the money to travel to his place, and as long as we are there, we are going to take advantage of it.

**MR. BRADBERRY:** We are not only doing a physical survey of the facility itself, we are also trying to educate the person who is using it. Too many of these people have no concept of what filtration is. They have no concept of what collimation is. We have got to take the time to educate this person. This is where the time is involved. We "guesstimate" 30 minutes to do a physical survey on a single tube, if there's nothing wrong. This does not count educating the person.

**MR. KARP:** We run a combination program of education and physical surveys, because we have found that the places with the educated technicians have few problems.

**MR. FUENTE:** How effective has your educational program been? I mean, if you go back and resurvey this same facility, do you still find the dust on the cone or collimators?

**MR. KARP:** No. In these places where we can educate, we don't find it. In the hospitals where there are a number of technicians we run into a different problem, because there are too many people to try to educate at one time. But with a single practitioner of healing arts, yes.

**MR. FUENTE:** Do you educate them as an individual or as a group?

MR. KARP: As an individual.

MR. FRY: I'll not buy an equipment inspection where you go in and just click off a list of equipment checks. I feel that the educational aspects are necessary even in the initial surveys.

MR. BRADBERRY: Most problems are associated with the smaller hospitals. Here the radiologists come into town maybe once or twice a week, and probably are off a couple of afternoons a week. This is where you corner the technicians. This is where you corner the people in the hospital. They are very much interested, not so much from a physical survey standpoint, but as to, "How much radiation am I receiving?" Unfortunately, you can't see the harm from radiation. So as soon as we walk out, they may begin to forget some of the things that we have told them.

MR. FRY: This also speaks to the area of the whys behind reinspection. We want to get back every two or three years to talk to the technician. If you're fortunate enough to be able to get in more frequently than that, it's even better. I think the educational aspects will have a lot of influence on your resurvey frequency.

MR. DEROSE: I would like to ask you about initial surveys. You didn't mention shielding. Does this fit somewhere in your initial survey program?

MR. FRY: In general, shielding other than the operator's protection in the average diagnostic facility in our area is adequate. Personally, I think with diagnostic units, other than operator protection, the X-ray people and the architects do a pretty good job. Now, when you come into therapy installations, I find a great number of them have been evaluated professionally by private consultants and are all right.

MR. HILTON: We found it a little different in Mississippi. Our architects and builders don't know anything about X ray. We have to start from scratch with them.

MR. FRY: Somebody told them in Kentucky to put one-eighth to one-quarter of an inch of lead in everything.

MR. HILTON: I wanted to go back just a minute and ask how many surveys a day can your men make taking an hour to talk to each technician?

MR. DILLARD: We don't spend an hour. We figure that about eight surveys - eight tube heads in a day - is a pretty good day for us.

MR. RUSSEY: Another method that hasn't been mentioned is to attend X-ray Technician Society meetings and talk with them about radiation protection in general. Here they are all in one place and all seem to be interested. A close relationship with these societies can help your program in many ways. One advantage is that you are better able to keep on top of your registration program. The technicians will tell you if a doctor has moved, sold his X-ray equipment, or bought new equipment. Occasionally, the commerce man will call us, but sometimes they get a little lax.

**MR. FRY:** We amended our regulations this time so that the X-ray sales people must notify us of the transfers they make.

**MR. BRITAIN:** I just want to learn a little more about the Georgia Survey program. Do you have the same luck in the private MD's office? Do you realize the average length of employment of an X-ray operator? How many years is it going to take you to see all your installations?

**MR. KARP:** Ten years to see all the facilities, unless we can increase our staff. The average length of employment of a technician is about two and a half years. If we can get back every three or four years, we will get him.

**MR. BRITAIN:** You talk about spending three or four hours in a hospital. What about an MD's office?

**MR. KARP:** Now, we do very little preaching in the hospital. I mean, we do preach if they are willing to accept. We spend a lot of time in a hospital, but it is not like you would in a private practitioner's office. There, as someone said, they call you and they want these answers. This is where we spend an awful lot of time.

### A Private Consultant's Viewpoint - Randall W. Carter, M.S.[1]

I rather feel like I am in a minority today with all the government people present. The surveys which I performed are in the capacity of a private consultant to individuals; therefore, I guess I take a different approach than many government agencies might take, and when I do a survey it is rather complete, or at least I hope it is complete.

I have general guidelines which I use to -- or philosophy, you might say -- carry me through a survey. These quidelines are: (1) to determine that radiation levels in an area are the minimum practicable as consistent with the maximum diagnostic information and/or therapeutic value; (2) to determine that unnecessary radiation exposure is not administered to the patient or operators due to the use of substandard equipment; and (3) to determine that an adequate program of radiation safety is established and, I hope, followed. This would include personnel monitoring, protective clothing, other protective devices, shielding in the facility, and equipment standards; that is, to determine that recommendations -- or requirements -- are met by the equipment.

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One area which might be considered in our discussions today is what happens to the recommendations when they are made? We discussed education of X-ray technicians, physicians, secretaries, and other people that might push buttons on X-ray machines. One of the important areas of education that we might be overlooking is the education of hospital administrators as to the necessity of some of the changes which are recommended.

I have prepared a list of items which I check when I go through a facility. I have broken it down into about four general categories, and I will list the items I think are the most important from the standpoint of radiation protection.

On an overhead unit I check the half-value layer (HVL). I actually measure the HVL. I check the collimation, the cones. I check beam alignment. I do take scatter measurements. I check the timer. And in the course of this, I get the output of the machine. This is not necessarily very important, but it might give an idea as to how these machines compare with published information in tables. Through gathering all this information, you can make some sort of rough determination as to whether the equipment is properly operating or not.

For fluoroscopic units, I take table-top output, measure the HVL, and make certain lead drapes are hanging from the screen or image intensifier. I check for bucky-slot covers. I check the beam alignment, and I check it with the fluoroscope, both in the vertical and horizontal position, since when the fluoroscope is raised to the vertical position, you might find that the tube drops because it is not securely fastened. I check the beam margin on the screen. I make certain that there is a dead man's switch, so that the machine can't be inadvertently left on. I make sure that the shutter control mechanism is functioning properly and smooth -- easy to operate -- so they can cone down if possible. I take scatter measurements around the fluoroscope and around the installation. I make certain that the tube is mechanically and electrically connected to the screen so that the screen must intercept the beam, so that the tube cannot be activated or that the screen cannot be separated mechanically from the tube. In cases where it is applicable, I make screen transmission measurements. I measure target-to-panel distance. And lastly, I check for the 5-minute cumulative timer to be sure that it is there.

For therapy installations, the procedure is a little different. Usually when I am called into a therapy installation, I first perform a complete calibration on the output of the machines for the various field sizes and the kVps under which they normally operate. I perform a radiation survey of the environment on a therapy unit with a survey meter. With some superficial machines, you will find that it is necessary to make scatter measurements within the room because some of the units that only operate up to 100 kVp have the operator's station inside the room. I check for warning lights and door interlocks.

One of the most important things in surveying therapy installations is to check the timer very carefully. Most of them have the synchronized type timer, which is a good unit, but I have found that the timer, when the clutch starts slipping, can come around to zero and stick without turning the machine off. I check for patient viewing. In the case of the therapy machine, I always check if they have a light localizer or some other means of defining the field on the patient. I check for alignment of the field; that is, the X-ray field, with the light localizer, or whatever means they use.

For the facility part of the survey, I check the radiation protection program. I also usually ask a few questions of two or three technologists around the area. I check their personnel monitoring records for at least a couple of years to be sure they have adequate records. And, in general, I check their protective clothing. This is particularly applicable with cystoscopic units. With cysto units I always take scatter measurements at the position of the urologist. Of particular concern are the urologist and the physician who might be performing a cardiac catheterization -- their hands and forearms. Also one finds of concern the anesthesiologist in certain special procedures. I always make recommendations that these individuals should have adequate personnel monitoring to determine, if possible, what radiation exposure they might be getting.

Regarding the shielding in a facility, I don't like to go in and determine if the shielding in a wall meets compliance with the various handbooks and recommendations. I do perform area surveys occasionally, but when I do, it simply is to set up a film badge monitoring program to determine radiation levels in areas in the facility under actual operating conditions.

I think this very briefly and rapidly covers what I do on an inspection. Now, there is one great difference between myself and the government individual. When I am called upon to do a survey for someone, they have requested that I come and they are looking forward to the service that I can give them and the advice which I will subsequently render. It doesn't mean it is always going to be followed, but they have at least elicited the advice, and they pay for it.

## Discussion (entire group)

MR. HILTON: What instruments do you use to calibrate a therapy unit? Also, I want to know the range of the chambers.

MR. CARTER: The instrument which I use is the Victoreen Condenser R-Meter, and the range will depend upon the kVp and filtration to some extent. As a general rule, I will use the 131 Chamber (100 R maximum range) for energy below about 140 kVp, because below that kVp and filtration, you usually find exposure goes up. Below about 80 kVp, I use a 651 Chamber (250 R range). This is an end window chamber. In general, I use a 70-5 Chamber (25 R range) at the higher filtrations, with the higher kilovolts.

MR. HILTON: What percentage of the therapy units do you find not in calibration?

MR. CARTER: We would almost have to set some limits as to what you meant by out of calibration. If you're talking about 5 percent, then I would say about 30 percent of them are out of calibration. If you want to set the limit at 20 percent, then a fewer number. So it varies.

MR. HILTON: Do you require interlocks for superficial therapy and recommend them if they are not present?

MR. CARTER: Yes, I do. Mainly because most of my work is in the State of Georgia, and the State of Georgia requires interlocks in their rules and regulations.

MR. LUBENAU: What precipitates the request for your services?

MR. CARTER: Most of the requests that I have come from radiologists by word of mouth. I teach the physics course to the radiology residents at Emory, and therefore, there's a big audience in the State of Georgia that knows me. A radiologist that moves into a new facility and wants to find out what he has or what the requirements are might call me. Now, this is not true of the calibration services. About 30 percent of the calibration services which I perform are for dermatologists and a few general practitioners.

MR. RUSSEY: Do you use a Cutie Pie, and if so, what make do you use for scatter measurement determinations?

MR. CARTER: Yes, I use a Nuclear Chicago Integrating Cutie Pie. One has to be somewhat careful in the use of this instrument because of the saturation response. That is, if you get into a field which has too high an exposure rate, you start having saturation losses in the chamber. Fortunately, in the diagnostic X-ray machine output range, it is awfully hard to exceed a saturation loss of more than about 10 percent without exceeding the range of the scale that you happen to be working on.

MR. BRADBERRY: Is it just a physical check you make on your synchronization timer?

MR. CARTER: I use a stop-watch.

MR. LITTLE: How much time does it take to do your survey per X-ray machine and per X-ray tube.

MR. CARTER: I can do an overhead tube and fluoroscope in one room in about 30 or 45 minutes, say 45 minutes average. I like to take someone with me who can do the work while I talk to the radiologist, because I do find that they want to ask questions regarding protection, equipment, etc.

**MR. LITTLE:** Does this include looking at the entire physical plant involving this machine, such as the darkroom?

**MR. CARTER:** I do not look at the darkroom. For facility shielding, I will take scatter measurements in the operator's area. As far as the actual wall shielding, I would prefer to set this up on a film badge basis and do it over a 6- to 12-month period.

**MR. BRADBERRY:** Several times this morning people were talking about techniques and regulations of techniques. I don't understand how you can tell or expect the doctor to do the same thing, because technique is different from one individual to another.

**MR. CARTER:** To rephrase your question, I think you're asking, how can one regulate and police techniques. I personally don't feel that you can, and I think that any attempt to do so will lead down a road which is impossible to follow, to regulate, and to police. I feel that technique and technique learning must come through educational experience, and I think much of our effort should be directed in this area.

**MR. PAYNE:** On your diagnostic inspections, what items do you find to be correct 99.99 percent of the time, almost to the extent that you would wonder whether or not you would really need to look at these things much longer, or do you find any?

**MR. CARTER:** This depends on the vintage of the machine. If you walk in and see a good, new machine, one which looks like it has been made in the last 4 or 5 years, you really don't anticipate much of a problem with most of the things I have discussed. You occasionally will run into misalignment of the beam, but other than that, collimation is usually good, and HVL is usually put in by the vendor, I think it's very appropriate that equipment specifications be written into rules and regulations requiring manufacturers to meet these specifications.

**MR. PAYNE:** I don't want to get into resurveys right now, but how would this sort of thing fit into your evaluation in setting up the item for a resurvey?

**MR. CARTER:** Usually when I go back, unless I can determine that something has been changed, I will do very little in terms of physical measurements. If you measure what it is going to do under a given set of circumstances, the next time you go back, unless you made an error, it should do the same thing. If there has been a change in the tube, transformer, valves or a number of other things, the output of the tube could be affected. But as long as they have not had service on the tube, and as long as they have told you that they haven't had to double mAs to get the same density on the film, then you really wouldn't expect things to change too much.

**MR. FUENTE:** Randy, if someone asks for your services, do you attempt to correct deficiencies, or do you just make recommendations?

MR. CARTER: As a consultant, they are paying for my advice, and all that I can do is recommend. I walk right up and tell the radiologist, "You have a tube that is defective and you should call the service man." I have never had one say he wouldn't do it. These people, in the first place, are interested in finding out what they have and making it correct.

MR. FRY: This, I think, is a major point. The difference is that a very receptive facility has employed you. It is true that they will ignore your recommendations on occasion, but it is ridiculous to pay your fee and then not do what you tell them to do.

MR. CARTER: Usually I have found when my recommendations have not been implemented, it was because the hospital administrators wouldn't appropriate money.

MR. FRY: This is a point I wanted to make about who we see in a hospital. We have learned from the Atomic Energy Commission that you can't go too high to start, and you can't leave your recommendations with too big a man but you can make the mistake going in the other direction. We have survey result sheets in our files signed by X-ray technicians. There is no need for him to even put his name on it since he isn't authorized to get things fixed. You need to talk to the radiologist and even the administrator.

MR. VILLFORTH: Dick, you emphasized that your initial survey was based on the minimum of points. I was wondering, after listening to Randy's discussion of the types of things that he examines for a diagnostic facility, if you do anything less than that in an initial survey.

MR. FRY: No, and I'm glad you asked. I did not imply this was all we did. We had a page full of things we checked -- timers and other things. These were the points we stressed. If the fluoroscope didn't have a 5-minute timer on it, we didn't raise a furor over it. We were more concerned about getting the 20 R per minute output reduced.

MR. BRADBERRY: But did you point out that it didn't have a 5-minute timer on it?

MR. FRY: In some cases, yes, and in some cases no. I feel the least important item in the fluoroscope survey is that the fluoroscope has a timer on it.

MR. LITTLE: Dick, I would just like to discuss that point about what an initial survey should consist of. We did look at some of the advantages of a more comprehensive survey by Mr. Karp, and the fact that you prefer the partial-type survey. The comprehensiveness of the survey should be based upon the number of facilities that you have to look at, how often you want to look at them and how many people you have in your program.

So perhaps in your program, Mr. Karp, you could do a comprehensive survey, if you have enough people to do it. Whereas, in another program, in order for them to make frequent contacts and to develop rapport with the profession so that professional users will know that there is a State program and that they are trying to make corrections, I would think that that program would have to cut back on the comprehensiveness of the survey. They could look at only a phase of it or a certain aspect of it and come back later and look at it again. This will permit him to contact more facilities and to contact them more frequently.

Again, let me say one more point on the subject of education. Although it is very effective to educate an individual user, it is not a very efficient way of educating the great numbers that need to be educated. One should limit the amount of time that he spends in individual education, and perhaps go at it in group therapy. I know of some States that are doing this with the X-ray technician. The State program is offering pilot training projects at X-ray technician schools. They are going to the schools, and they are giving a pilot training course. The course covers the radiation protection aspect of X-ray technology which usually consists of about 12 or 15 hours of intensive training. So this, I think, will be much more effective and more efficient than training the individual.

MR. KARP: Definitely, but the other has its place, too. And you will see that we cover all areas.

MR. LITTLE: To a limited extent, the other has its place, but it should be based on how many people are available and how many places you want to inspect.
MR. GRAHAM: Randy, how do you check for beam alignment on a radiographic machine?

MR. CARTER: It depends on the type of machine. If it has a light localizer, it is relatively easy to do. If it has a central axis beam, it is relatively easy to do. If the technician uses a light localizer to get a certain size field outline what they want to radiograph, I will take the light localizer and shoot it down at the cassette with lead markers in the corners of the light field and then compare the beam margin of the developed film with the position of the lead. With the central axis beam, I will simply put a spot of lead where the light shows the center of the beam should be. With the eyeball-type unit, I put a little piece of lead on the cassette and hang it over on the wall. I tell the technician, "All right, eyeball it over there," and then see how close they come. That's about all you can do with that one.

DR. COLE: I find myself sitting here wearing a coat of many colors. First, I was a practitioner with a machine, the fluoroscope, in the corner, with which I think you are all familiar. Second, I am a radiologist. Third, I am a surveyor for the American College of Radiology, as well as an officer of that organization. And lastly, I am a "FED." I figure that this conglomeration of things puts me in a unique position.

I would like to defend a couple of things about doctors in general; "the man with the machine in the corner." Perhaps you have read the testimony that came out in the Hearings on HR10790 in August, in which Dr. Raventos from the University of Pennsylvania was asked, and later submitted a statement, as to how many hours did the average medical student receive in X-ray protection. This data had been gathered by Dr. Chamberlain in 1962. It came out to be 4.4 hours. Now, this is not semester hours. This is a term that came out at the hearing just last week known as "clock-hours." Well, I think you could all appreciate that trying to teach a medical student, who is not interested in the first place, very much about X-ray protection in 4.4 hours is rather difficult. I think Howard Goldman in his testimony last week said that the State of New York required 30 hours of X-ray protection for technologists in comparison to what the doctors were receiving.

Many of the medical schools, as you perhaps know, are going through what is called a core curriculum change in which the first two years of the basic sciences have been radically changed, leaving the last two years, in a sense, to elective courses. Many of these men, fortunately for us, are taking these elective courses in radiology. For example, at the Medical College of Virginia, this is a 16-hour course in the third and fourth year. Many times these elective courses consist only of viewing a produced film. I think that, after listening today, the average physician requires a great deal more time in the preparation of the film, and this is the place where we come into the act.

Another thing that I have been interested in, and which actually brought me into the Public Health Service after being in practice some 15 or 20 years as a radiologist, was the feeling, as I am hearing here today, that the situation is not good. I differ with what Dr. Chamberlain said at the hearings, "that things are not bad." They are not too good. I am of the opinion that we sooner or later are going to have to require from physicians some type of proficiency standard before they can buy an X-ray machine.

As it is now, anyone that has a license to practice medicine and surgery in the 50 States can buy any type of machine he wishes. Whether he operates it correctly, or whether he knows how to operate it, is immaterial. I feel that in time a proficiency standard will come into being. I also believe that the States sooner or later are going to require, as California is now trying, that the graduating MD, to obtain his license, must know something about radiation, and that questions on this subject will be on the State Boards.

The National Board of Examinations might be a place to start. If we could get this on their program, and I really don't think we would meet too much resistance, it would help. There is another group called the Federation of State Examiners putting out a comprehensive type of examination to the graduating MD known as FLEX. This examination is a comprehensive type of examination which they hope will be recognized by the 50 States, so that a physician moving around, if he wishes to, doesn't have to go through the task of retaking the examinations and getting his certificate to practice in each State. This would be an ideal situation, very much like, I think, the technicians wish to do. They wish to get a uniform standard that can be recognized in the States.

The point that I gather today is that physicians, excluding most radiologists, lack knowledge in the use of their equipment. I think that this is the primary thing and I am sure you all have realized this. They have not had the opportunity to actually learn how to handle their equipment or to learn the basic facts of radiation protection. At least we can get some information on this as to whether or not the States are interested in putting this on their State Boards. I think that is a big step in the right direction.

There is a study going on at the present time called "Self-Evaluation." I'm on the committee for the American College of Radiology that is going to inaugurate this procedure on Saturday. We are having a meeting in Washington in an effort to set up an inspection group of radiologists to go into a hospital, or a doctor's office, watch him work, look at his techniques, look at his films, and watch him read them.

Now, someone mentioned a while ago about the accreditation by the Joint Commission. This would be a step that the Georgia Commission would welcome if the radiologist in a hospital, for example, agrees to have a self-evaluation examination. The only catch is that the radiologists have to pay for this examination, so this has been a stumbling block.

I am sure you all know Dr. Russell Morgan at Johns Hopkins University. He told me not too long ago that he has a chronic problem with his technicians. He ran a survey on the use of collimation and he found that the technicians in the rush and haste got a bit careless in its use. It seemed to him that there has to be a constant effort to reeducate the technicians to make them do what they know how to do.

Last but not least, is the possibility of malpractice. I have been in court, having been sued once for alleged misuse of radiation. We speak of decreasing exposure of patients, but let me assure you, many times physicians take these films, although it might not appear necessary. There is always that possibility that if he didn't take that film or he didn't re-X-ray the wrist or the pelvis that might have a fracture, that the result could turn out badly. Whether he took the film or not is immaterial, but he might end up in court. You must realize that one out of five physicians throughout the country ends up in court sooner or later for malpractice. I have had physicians call me over the phone to say, "I hate to repeat this chest film so soon, but this child might have something serious, so, therefore, go ahead and take another one." In some defense of the physicians, I would like to emphasize that point, because you don't see it too much in the literature. But let me tell you, it is always present, and having been to court, I think I am sometimes a little bit allergic, so I may take X rays that are not entirely necessary.

MR. FRY: Getting back to the concept of initial surveys -- what constitutes them? What should you be doing? There is a very distinct interest in some of the States in saying, "Well, we still have a lot of initial surveys yet to make. We would like to bypass some of your mistakes. I think we deserve the help of getting to know all of the pitfalls."

MR. HILTON: When you first surveyed, did you concentrate on the educational aspect, or mainly on the equipment?

MR. FRY: We concentrated on the equipment the first time around. Education is a primary point the second time around.

MR. FETZ: Do you go into a facility unannounced in the sense that you haven't let the man know you're coming?

MR. FRY: The vast majority of facilities are done completely unannounced. As the facility gets larger, you have to make some kind of arrangements. The hospitals, obviously, should be contacted but not the private dental and medical offices. We often call ahead once we are in town and say, "We will be there later today or tomorrow," especially if we think he may have moved, and we don't know where he is. We are very receptive to the excuse, "I am busy now." This, again, gets back to the area concept -- we are in that area to do that whole county, and "If we can't see you this morning, will you be free tomorrow afternoon, because we are still going to be here." It's seldom you leave one because you can't find the man or you can't get into his office to see him.

MR. FETZ: What do some of the other States do?

MR. BRITAIN: North Carolina uses Kentucky's approach.

MR. CLARK: In Florida it's a little bit faster for us to make appointments. Contact is made by telephone. We either go to the county to make the calls or we get the local County Health Department to let them know we are coming in this week, and then try to narrow it down to a time convenient for the physician.

MR. LUBENAU: We come in unannounced. Of course, with the larger facilities we recognize the need to make an appointment.

MR. DILLARD: We have found it very, very easy for a physician to tell you he is busy if you talk to him by phone. That's why we don't call.

MR. CLARK: I have one question, Dick. If you still had a large number of initial surveys to make, what changes would you make in your program? I mean, how would you shorten it? Would you leave out certain aspects?

**MR. FRY:** I would go back as we did the last time, but I would not miss anybody. In other words, if I went into a particular area, I would make an effort to see everybody there, because once you miss him, he will be on a different inspection cycle from the other users in his county. I would also spend more time with the user.

**MR. FETZ:** Randy, is your initial survey the first time in a facility the same as your initial survey was five years ago?

**MR. CARTER:** Yes.

**MR. DILLARD:** Dick, I think there may be some points to bring out here. The failures of the Kentucky program are being uncovered by the findings on the resurveys. During our initial surveys, many times the same X-ray technician who we performed the inspection with was the person that signed the document stating he would get the deficiencies corrected. Then we came back three years later and found exactly what we left after sending out cards and letters and receiving the reply. "Yes, we have got it fixed." I think it is important to see the individual in charge.

**MR. BRITAIN:** I think it is very important to ask for a reply to a noncompliance item that needs to be corrected. Don't let the physician merely tell you that he made the correction. Have him tell you what he did to make the correction.

**MR. FRY:** The collimation field is not licked. The fact is that many, many machines have only one or two model cones that will fit it without considerable amount of rework being done. When we made our initial surveys, there was a different interpretation on collimation as to what was adequate. At that stage, we were trying to get the field down to the size of the part of the body being studied. We wrote into our regulations that the field be collimated "to the area of clinical interest." This is the uniform interpretation adopted in NCRP Handbook 33. Handbook 33 limits the diameter of the field with a fixed cone for a 14" x 17", at 72" to 16". You're talking about a diameter of 16 inches to cover a 14" x 17" cassette.

**MR. FUENTE:** I would like to get some feelings from these other States on three or four items that we haven't touched on. One, who operates the equipment? Do the surveyors, the technicians or the radiologists? Second, if the surveyor operates equipment, does he get verbal or written approval from the chief technician, or radiologist, or hospital administrator to do this? Has there been any time, when the surveyor was operating the equipment, that some damage was caused to the equipment?

**MR. FRY:** Since your question requires an answer from everybody, let me turn it around. Does anyone have standard operating procedures other than having the technician run it for you?

MR. RUSSEY: We have a form that we use in cases like that, which is signed by the owner. It gives us permission to turn on that machine and operate it during the procedure. But if the technician is there, we would rather have him do it.

MR. SEABRON: In New Jersey we didn't operate on a pop-in basis. We always had an appointment. This was done for two reasons. First, we wanted the doctor there. By getting on his calendar, we were sure he would be there. Secondly, if he said he could not be there, to get permission to operate the equipment we mailed him a waiver, which he signed and which released our man from any responsibility should anything go wrong with the equipment.

But by getting on the doctor's calendar, in 95 percent of the cases, he was there. When the surveyor was finished, we could discuss the results with the doctor. By having the doctor sign a statement that he understood all the items of noncompliance which had been indicated on the report form, and that he would notify the department within 30 days of steps taken to correct said deficiencies, we were getting two things done: (1) We eliminated a letter telling him what we found wrong, and (2) we got an oral and written commitment from him that "I will notify you in 30 days. I do understand what was wrong." We found this shortcut increased our compliance by a great deal.

Getting back to the original question, we ran into a problem where one of our men blew a tube. We told the commissioner that we were going to get a bill for a tube replacement. We asked if we were covered under the State liability insurance for this type of damage. It finally got up to the attorney general's office before we got an opinion. And the opinion came back, "This time, okay, but from here on in, if you can't get a waiver to operate the equipment, don't operate it."

MR. FRY: There's another aspect of this. How do you do a survey of technique? We go in the darkroom and talk about processing film. Without a technician, not only to run the machine, but to tell you how they run it and what they do, it would be extremely difficult to do our surveys.

MR. BRITAIN: What about a fluoroscopic survey? You have to perform that. There're no two ways about that.

MR. FRY: We run the fluoroscopes under the watchful eye of the operator. We always ask them to set it up.

MR. BRADBERRY: Each piece of equipment operates a little bit differently, so this is why I think it is important that the technician set up the machine for us.

MR. CARTER: If you understand the operation of the equipment, I don't see personally anything wrong with operating the equipment, and I do operate the equipment.

MR. RUSSEY: We find it is very important that we make it a standard procedure if the technician is there to turn the machine on and see that it is operating properly before we leave.

MR. HILTON: I would like to know how many technicians have blown tubes with the surveyor present? Usually they don't know anything about the tube limitations. I feel like it is safer for me to operate it.

MR. FRY: This gets back to what you tell the technician to do. We do not tell the technician, "Set this at your maximum milliamps for a second and a half, because I have got that long of a time constant." We will go back to them and say, "What is the longest exposure that you normally use?" Now, if it is on a high-milliamp unit that is run on real short times, and they may never take anything for longer than a tenth of a second, then you have to do some manipulating for them, or use an integration-type survey meter. This works very well with the photofluorographic units.

MR. KARP: In Georgia, we have standardized on techniques. In any horizontal shots, we use 50 mAs; any vertical shots, we use 10 mAs; and with any other techniques we calculate up or down.

## Federal Viewpoint - James W. Miller, D.D.S., M.P.H.[1]

From the Federal level, our concept, following the outline, is that radiation is potentially hazardous and biologically undesirable, and diagnostic X rays are the major source of exposure to the population. Our objective, as stated when this Symposium started, was "Let's eliminate or reduce all the unnecessary radiation without interfering with the beneficial part of it." Our approach to accomplishing this in the diagnostic field is, as it has been traditionally, "Let the States do it." Our job is "How can we help States do it better and faster?" But our attitude was always,"Let's do something now and in a hurry, because we had the requirement to produce results -- to define the problem nationally, and to determine methods of controlling unnecessary exposure."

We had to know what the States were doing, what progress have they made, and methods of evaluating exposure reduction. Our first major effort, as Mr. Little pointed out, to assist States and reduce exposure was the dental Surpak.

The Surpak was so successful and demonstrated that a simple procedure could reduce exposure to the population, that we pursued the development of a medical Surpak as well, for a good number of years. We had prototype after prototype of a medical Surpak. The point was reached where the medical Surpak would work, the instructions were clear, simple, concise, and we field-tested this in Rhode Island, Mississippi, and Nevada. One of the problems in using the medical Surpak was that States had to have a good up-to-date registration program, which most States did not have, at least when we field-tested the prototype. Results of these surveys indicated that the medical Surpak was not suitable for large-scale distribution.

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In looking at the problem of X ray, we go back to those three areas that have been mentioned many times -- the equipment, technique, and judgment. In the early days of the program there were existing standards for equipment, and we knew we could do something with the equipment right away; we had to have information about the techniques used also, and felt we needed to cover techniques in our surveys. We really didn't know how to approach the judgment aspect. We left that for the future, and it looks like we may be approaching that area now.

In preparing to ask States to inspect X-ray installations, we needed a survey form. A form serves as a guide when doing a survey so that all items are considered and provides a source of data for reporting program progress or accomplishments. We designed a survey form which we hoped States would adopt to provide uniform national data; this proved to be a very frustrating experience.

In developing the form, we took all of the "shoulds" and "shalls" from Handbook 76 and the recommendations from the Council of State Governments' model regulations, plus all of the items that have been on survey forms since you all started doing inspections. These were all listed, and then we sat down with a group of experts and went through them, item by item. Each item was considered in terms of "Is this necessary? And, if it is, why?" There were items that we wanted on the form that are not covered by regulations. We thought a survey should be an educational experience for the physician and technician as well, so important items like asking about gonadal shielding were included. The form was designed so that, if some States didn't want to use certain parts or ask certain questions, they could leave these blank, and we would still have some uniform data that we could use nationally.

Now, what constitutes satisfactory initial X-ray surveys? To me, this depends on people, money, and things -- how much money you have to put into the program, how many people can go out and do the surveys, and how much equipment you have. The important thing is that you do something. Now, if all of you truly believe that radiation is potentially hazardous and biologically undesirable, but feel that if we don't get around for ten years, so what, then I think you're in the wrong business. With limited manpower, you have to tailor your program accordingly. If all you can do is a limited survey, you look at what is the major source of population exposure from diagnostic radiation. In such a case you would check collimation the first time around, and as your program grows and you have further defined your problem and justified your program to people who control the purse strings, you can improve and add on to your survey procedures. But to do nothing until you can do it perfectly, to me, is not public health.

Discussion (entire group)

MR. FETZ: You are keeping statistics of these surveys that State programs are doing, and unfortunately, you're not defining apples, oranges, and bananas, because a survey is not a survey, and some people look good and some people look bad. I think you people are going to have to decide what a survey is in the light of a lot of conversation, and you are going to have to define surveys into an (a), (b), and (c) category. Let's determine how many (a)-type surveys are done, and how many (b)-type, and how many (c)-type, and keep your statistics in that light.

MR. FRY: I don't think they can make the decision in Washington that this is a Class-A survey and another is Class B. A survey that is A Grade for Georgia, with Georgia's resources and people, is the best for their situation and their data management. You will see that data management in one State is entirely different in how it is handled in another. I don't know if you could say, "This constitutes a good, Grade A survey."

MR. LITTLE: Let's give a specific example of what I think Dick Fetz was talking about in the annual inventory that the Public Health Service is doing. Information is collected on the number of surveys done by a State program, and the number of dental surveys and medical surveys completed; and then the next question is how many facilities did you find deficient? Now, I heard one of the State representatives here mention that 98 percent of the X-ray facilities corrected their deficiencies before the next deficiency. Is this a fantastic improvement or a different way of defining deficiency?

The fact remains that you're getting numbers here that mean one thing to one State and another thing to another State. It shows one State in a very favorable light in terms of corrections and another State in a very unfavorable light. Yet the one that's in the unfavorable light may really have the more effective program.

DR. MILLER: That's true, but it is the best we can get. It is better than what any of the other environmental health programs are collecting. With this day and age of partnerships, comprehensive health planning, we are about the only program that has any type of data over the last five years.

MR. FRY: I think one aspect of an initial survey is a positive identification of where you are, what's there and how much it is used. Most of us would agree that you want an estimation of how much this facility is being used, when you are there the very first time. Everything else is going to be influenced by the workload. I would say an initial survey would cover, certainly, all the requirements, your surveys should cover all of the points that you have in your regulations.

MR. KARP: We don't use the PHS forms. The information we require in some cases is a little different. PHS forms are good. They are very good. It's just that we find it is easier to record our data a little bit better on our particular forms. For instance, if one has a variable collimator in the installation, this is fine. You can check this easily. What if they are using cones? You have to have some way of determining if this installation has the right assortment of cones for the particular films they use. We measure the HVL on every machine. This gives us an output of the machine and determines if the filtration is proper. We do a timer check. We do a spinning top test. We do a film-screen contact. The most important thing is the workload. We have a different way of determining the workload. So our forms are made for our requirements, not for PHS requirements.

MR. FRY: I think the point here is that we are covering essentially the same materials. We are interested in adequate filtration and approach it from the standpoint of HVL.

I expect we could go through Handbook 33 point by point and pick off the items and would say, "Yes, these all constitute items to check." How thoroughly they are checked, and more importantly, what constitutes compliance with that requirement, is also important. I like the fact that NCRP Handbook 33 has a comment section. It tells you why, and how and what, about the requirements. This is a great improvement over NBS Handbook 76.

But we still don't agree as to what is compliance. I talk about 60 or 70 percent and you talk about 80 or 90 percent. So there is a need, Mac, as you brought out, of establishing not only uniform standards, but interpretation of such standards.

MR. RUSSEY: I have not yet reviewed all of your forms. But, to make a point, no radiographic X-ray equipment is better than the darkroom. If the film turns out bad, this results in taking another exposure.

MR. KARP: If you do a spinning top test or a film-screen contact, you can watch the operator develop his film and observe his technique. This is how we check a darkroom.

MR. RUSSEY: Automatic developing equipment is going in fast, expecially into hospitals, radiologists' offices and clinics, and also into the private practitioner's office. Because of the constant developing technique used with this automatic equipment, one soon learns if he is using too long an exposure time or too many kilovolts.

MR. BRITAIN: Getting back to the use of the PHS forms, Dick, having experienced three State radiation protection programs, I see no reason why these forms couldn't be used as a standard in most, if not all, programs. At the same time we would all have the benefit of a common data management system.

**MR. FRY:** More so than the form, I think the consensus of this group would be that the information requested on a PHS survey form is the type of information that should be gathered on an initial survey. How it's gathered, and how it's collected and analyzed may be a particular function of a given State. But the things to be checked are the standards that are adopted in N.C.R.P., and we go along with them.

We talk a lot about model regulations from Council of State Governments. They are model regulations for States to adopt or at least utilize, but I have yet to run into a State radiological health man that had much, if any, input into developing these model regulations. I realize we do have input through the Public Health Service. The AEC writes the radioactive materials sections, and PHS writes the X-ray sections. Then the States are expected to adopt both of them and do the work. I would certainly say that from the Federal aspect, they have put on the PHS survey form the items which they think are important to cover during the survey.

**MR. DILLARD:** I think there's a unique advantage in the PHS form. You can simply go in and fill out the form, and you have done a tremendous amount of good right there. You don't have to carry out an elaborate educational program on that initial survey. You can simply get the form filled out.

**MR. BRITAIN:** The questions raised from the form would encourage discussion from the operators.

**MR. FRY:** I don't think the question is "Do you have a gonadal shield?" The topic out here in the left-hand margin is gonadal shielding. That says, "All right, you just covered filtration or collimation. Now twist the conversation to gonadal shielding."

**DR. MILLER:** We would like to see the PHS forms being used, of course, and would definitely appreciate it. However, if you don't want to, that's really your own decision. Based on your resources, people, travel money, equipment, automobiles and survey equipment, you should design a survey that will get around to all the diagnostic installations within the State in a reasonable amount of time. If you look just from filtration and/or collimation, make sure these two items are corrected, rather than just going in and taking a look-see.

**MR. LUBENAU:** The PHS forms were not available when we began surveying, and thus we do not use them. However, I am in favor of PHS forms, because eventually, hopefully, the results on those forms can be converted in realistic measuring terms, the reduction of dose to the population. We did it with dentistry. Somebody 10 years ago had the foresight in Pennsylvania to record workload and record the tip of cone exposure, and that enabled us to measure over the 10-year period the actual reduction in dental X-ray exposure in Pennsylvania. This is a realistic term. We can estimate the gonadal dose. This is what Dr. Miller meant, I think.

I think this is what the PHS is after. But it does mean sometimes collecting data that isn't readily meaningful during an initial survey. Sometimes it isn't easily accomplished. It is not achieved going in and measuring filtration. You have to do a little bit more.

MR. SEABRON: When we started in New Jersey, we used our own form because at that time the PHS forms were not available. When their system became available to us, where we could utilize their data processing and use their forms, we had completed toc many surveys. To switch over at that point would have meant manually transcribing thousands of survey results onto PHS forms. When we started our resurvey program, we went to PHS forms. Since we set our resurvey programs to do 20 percent of our units per year, we could give them all of the back data over a period of 5 years.

Now in New Jersey, they are using PHS forms, as well as their own New Jersey form, because there are some differences in New Jersey. Fluoroscopes are limited to 5 R per minute at the panel. PHS was following the N.C.R.P., and there was a 10 R per minute limit. So, for incompatibility such as this, we continued to use both our own State form, as well as the PHS form.

## RESURVEYS OF X-RAY FACILITIES

MR. PAYNE: In this session we shall endeavor to determine what constitutes a resurvey of an X-ray facility. We shall hear viewpoints from the State, county, and Federal levels represented by William Willis, Barry Robison, and LaVert Seabron respectively.

### A State Viewpoint - William Willis, M.S.[1]

Will you please refer to the pass-out sheet which was given to you (attached), which is labeled "Selected Comparisons of Alabama X-ray Survey Statistics."

We will use this as part of our discussion basis. First, I would like to point out we are relative late-comers in the X-ray field in Alabama. Our initial surveys were accomplished in 1963, on dental units, prior to the time that we had regulations. So consequently, the initial surveys were made to determine the status of the X-ray equipment. We realized at this time that we did not have the capability of going into the educational and judgment factors, so our interest was centered on the physical condition of the equipment.

Looking back, we find that rules and regulations were definitely warranted. At this time, PHS forms were available, and we wanted to get into the program as quickly as we could. So we adopted these forms and utilized them.

Jefferson County entered the radiological health program prior to the time of the State. I will try to refer to the State program separately and let Barry Robison talk about the Jefferson County program in a few moments.

The 1966 survey, which is indicated here, was part of a compliance survey. Basically, what we did was to record the condition found when we made this survey in 1966, and use this as a basis of comparison with the 1964 initial survey. Later on, we went into the compliance aspect. In other words, we wrote these people letters, telling them what was wrong with their units, and then we employed compliance with the regulations.

The regulations in Alabama consist of the "shall" provision of Handbook 76. In 1964, the medical X-ray units we recorded were something like 91.6 percent defective. this figure is probably high, based on the fact that some of the people we used during this survey were medical students, who were given about three weeks of training by PHS personnel in survey techniques. There were some misunderstandings, we found out, after all the data was acquired, on what was alignment and gonadal shielding. So they were reported more frequently than not as being defective. This gives a rather high ratio here. The figure in 1966 is 61.5 percent, and probably is closer to the actual figure. I think the main thing that this shows is the fact that if you make a survey and do not follow it up with some kind of regulations, you haven't really accomplished much, other than accumulated data for automatic data processing. You haven't really reduced the radiation load to the public.

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[1] Chief, Division of Radiological Health, Alabama Department of Health.

On the next page, going to the dental survey, there is an interesting note here. At the time of the 1963 survey, all units that were defective were corrected for filtration and collimation, or at least this was the instruction, and the PHS packets were inserted in the units where they were needed. So essentially, at the end of that survey we had a 100 percent compliance with the filtration and collimation part of the dental units in the State. We just started in April of this year a resurvey of dental units in the State. This is a lapse of approximately 5 years, and on the basis of 84 units we have inspected thus far, we came up with 18 percent of the units having inadequate filtration and 2.5 percent have inadequate collimation. I think it is a situation which justifies the necessity for resurveying. Essentially, these units were in compliance 5 years ago. There is also a possibility that perhaps in the initial survey the surveyors did not add adequate filtration and collimation in the first place. So it may be in this follow-up, we are picking up deficiencies in our own personnel at that time. But I thought this information would be of interest to show that just because you have your units in compliance at one time does not mean that they are going to stay there. This is a dynamic situation, and it is going to change.

## Discussion (entire group)

**DR. MCDOWELL:** On the first page is your definition of "defective" as being in noncompliance with any one of your recommendations?

**MR. WILLIS:** In this particular case, this included anything that's on a PHS form.

**DR. MCDOWELL:** And secondly, regarding the dental filtration, do you have any idea as to whether these machines were off by 0.5 millimeters or was this filtration totally removed? If, for example, they were only off by a half, it is quite possible that this was a survey error, whereas, if they were totally removed, why that's a horse of a different color.

**MR. WHATLEY:** I would say probably half of the time all of it is removed and maybe half of the time part of it was removed.

**DR. MILLER:** Had any of these units been serviced by X-ray repairmen?

**MR. WILLIS:** We had not specifically followed that point of questioning, and it might be well to consider this a little bit later in our survey.

**MR. ROESSLER:** I would guess it is difficult to use exactly the same criteria for "defective" in surveying the second time as you do the first time. We have already talked about how certain things are singled out as important the first time, and then we get a little more critical the second time around.

Perhaps we do need to break down to type and degree of inadequacy in making the comparison. It might also be revealing to make the comparisons on the basis of the first and second survey of the same machine. I wonder if there is a correlation with the findings of the second survey with the findings of the first survey, or whether they are completely independent of each other. Were the dental machines that did not have the collimation or filtration on the second survey the ones to which you had to add collimation and filtration the first time around? Were collimation and filtration removed between initial survey and resurvey, or is there no correlation?

**MR. WILLIS:** We don't know. At the present time, we have not tried a correlation like this, Chuck, because of the basis on which we have moved into an enforcement program. The owner that had a defective machine was informed of the deficiencies in the machine and follow-up was continued until this deficiency was corrected. At the present time, the "shall" provisions are in excess of 97 percent in compliance in the State of Alabama.

Unless there are some question on this comparison, I would like to go on with a couple of other items under "Resurveys." The approach, basically, now that we have regulations, is one of inspection. We do not use the "big stick" approach. We offer it as a service. At the same time, if they say they don't want it, we say, "We are sorry, but we are coming in anyway." But we have not been refused. The program has been well accepted.

As far as the frequency of priorities on resurveys, I was under the impression that it was necessary under the Medicare provisions to make a periodic resurvey of all medical facilities that are licensed, and this is basically the hospitals. We have adopted a priority system whereby all hospitals in the State will be inspected once a year at a minimum. We have not decided on a priority system for the general practitioners who have a very low workload. We are hoping that we can see all of these people at least on a 3-year basis, depending upon the workloads involved. We use the PHS form and enforce most items, with the exception of developing techniques. We will take the developing area up as part of the educational approach to the problem.

As far as methods of user contact are concerned, we started out with telephone calls when it was a volunteer program. We went around to medical society district meetings, talked to the people, explained the program and got their general support. It was well received. Since we now have rules and regulations, we have taken an area approach to surveying. We contact the large hospitals and try to schedule them in the afternoon, if it is possible. The usual method on the general practitioner is to just walk in and ask him if it is convenient for us to do the survey, and nine times out of ten, it is convenient.

We are very fortunate in the State of Alabama in that we have 10 men devoted to our radiological program. This includes the radioactive material, environmental health and the X-ray aspects. We have three full-time people in X-ray in the State program, and there are two full-time people in the Jefferson County program for X-ray control. This gives us five people for approximately 2500 units, total X-ray units in the State. This includes medical, dental, chiropractic, industrial, veterinary, etc.

MR. CARTER: I would like to clarify a point. Did you say that the resurvey was the same as the initial survey, including measurements?

MR. WILLIS: Yes, we do this routinely on our reinspections. If we go back to the hospital after a year, we make a complete resurvey.

MR. GRAHAM: What does this group recommend as a proper frequency of inspections. One person I know of has recommended an inspection every 6 months. What do you recommend?

MR. WILLIS: Bill, I think, again, it depends on how well staffed you are. My feeling is that the major installations, to be effective, should be visited at least once a year.

We do the same thing with our radioactive materials program. We have a schedule whereby we visit each one of them once a year, some of them more frequently. I think that we can't, of course, make 2500 surveys every year. We have something like 131 hospitals in the State, and certainly we can make a complete inspection of each one of these every year. As you know, this is where the vast majority of the exposure takes place. We can also visit the major clinics and radiologists' offices on a frequent basis.

Incidentally, we do not take the physician's word. When he sends a card back saying that he has made these corrections, a physical inspection is made on the site. In some cases where the service companies thought they had made proper corrections, our reinspections proved otherwise. Of course, the service companies were called back to make proper corrections.

MR. LITTLE: Is your reinspection the same as a resurvey, or is this just a check of the initial deficiencies?

MR. WILLIS: If there was a specific item, such as inadequate collimation, we check for only this one point. We don't go through the whole procedure.

MR. COWAN: I want to point out what I think is a significant factor in the first data here listed under "Medical Radiographic Units, '64 Survey and '66 Survey." I want to point out how not to perform a Statewide survey, because we really didn't accomplish much of anything.

The '64 survey was done without regulations. It was done with temporary personnel, some medical students and some dental students. It was done without any follow-up, and it was done by notifying the physicians through a rather ragged form that we drew up. These are the major faults that caused the failure of the survey. If you look at the '66 statistics, you find that the items of noncompliance have essentially not been reduced. What makes this hard to understand is that the first survey contained a couple of items that the latter survey didn't. So what I'm saying is that the '64 survey was essentially a waste of time. We could have accomplished so much more if we had gone about it a different way.

In the '66 survey, we had regulations. We had permanent personnel. We notified by letter, over the signature of State health officers. We had follow-up compliance visits in every case. We can certainly point to much, much greater progress, using these techniques.

DR. MCDOWELL: During a hospital survey, if the installation has a radioactive materials license, or radium, do you do a complete radiation protection evaluation of all the sources of ionizing radiation, or do you just do the X-ray?

MR. WILLIS: In the case of Alabama, we have two registered X-ray technicians that do the routine inspection of X-ray units. Radiation physicists do the inspection of the radioactive materials. Our X-ray technicians are not qualified to do the radioactive materials inspections.

MR. HILTON: Have you found any types of X-ray units that cannot be corrected?

MR. WHATLEY: The service companies sometime have trouble locating proper cones, and sometime even have to modify a tube head to make a cone acceptable to that unit. I don't think there are any units that can't be fixed.

MR. GRAHAM: Bill, do you require the lead drapes on fluoroscopic screen?

MR. WILLIS: This is a "should" provision, and our regulations are confined to "shall" provisions at this time. I personally have a lot of reservations about drapes on a fluoroscopic unit, if a radiologist is wearing an apron.

MR. CARTER: That is one item I very strongly recommend. If you take scatter measurements with a fluoroscope operating at 90 kVp and 2 mA, without the lead drapes, the rates run about 500 or 600 mR per hour in the fluoroscopist's position. With that little lead drape in there, the exposure will be cut down by a factor of about 15 or 20. And then with an apron on top of that, it will cut down even more. I think this is one of the very important things to be included in the survey and to be included in regulations. This is an item which can be required by law. You can't require a technician to reduce mAs and go up on kVp for a given film, but equipment items can be included in rules and regulations, and I think they should be.

MR. GRAHAM: Along that same line, we posed this question to the two radiologists on our Medical Advisory Committee. They felt that the lead flap on any fluoroscopic unit was a nuisance and that a lead apron would do just as well and recommended to us that we forget about it.

MR. HILTON: We had the same problem in Mississippi. We finally did include lead drapes in our new regulations. But let me ask your opinion. Do you think it should be a regulation to require lead drapes to be attached to a fluoroscopic screen?

MR. CARTER: That's one of the things that you can definitely inspect an individual for. And it is required for radiation protection, for the protection of the operator. I see no reason not to. To me, this is good health physics practice, and I think where good health physics practice can be included in regulations, there is no harm in including them. This is reduction of radiation exposure to the fluoroscopist. Now, your standard half-millimeter lead equivalent apron will reduce your dose by a factor of about eight to forty, depending on kVp. With lead drapes, you can cut that by another factor of twenty. I think the fluoroscopist and those people working with him should benefit by this added safety factor.

MR. WILLIS: When you get into this area, the "should" provisions, you can certainly go to the extent that image intensifications will be required on all units. This is the ultimate as we know it right now. But you have got to come back to the regulatory program, what can you reasonably attain? Now, you can attain perhaps a lead drape, but we are not yet, in Alabama, ready to require image intensification on all fluoroscopic units. But someday this will probably be required.

MR. CARTER: I would agree with that. We can't take all the fluoroscopes out of the outlying regions that don't have image intensifiers on them, because the medical service is necessary.

MR. PAYNE: I believe you said you would like to resurvey once a year. Did you mean this only for hospitals?

MR. WILLIS: Yes. I am not trying to set this up as a recommended frequency for very low workloads like general practitioners out in the country.

MR. PAYNE: Would you elaborate on your thinking? Why not once a year or two years?

MR. WILLIS: My philosophy is that in any radiation control program, any control program, if you can't go by and talk to the person responsible for the program in that institution once a year, he forgets that you're interested in him. Consequently, it is just good public relations, as much as anything else.

MR. PAYNE: Are you going to conduct the same type of physical surveys each time?

MR. WILLIS: Since we are just in this transition period between physical compliance and the educational approach, I think we will continue to conduct the same physical survey and perhaps move into some of the "should" provisions of the handbooks. At the same time, we will start implementing the educational approach.

MR. PAYNE: So you will have a change in emphasis on these resurveys as you go along?

MR. WILLIS: Yes, but you can't forget the physical inspection. You will continue to run into new problems and to inspect newly registered equipment. You're going to continue to pick up new operators of old units who have changed the operating techniques.

MR. PAYNE: We also talked about compliance surveys. How do these fit into the picture? Are you going to tie your resurvey in, or are they going to be one and the same, or are these going to be different?

MR. WILLIS: In our case, they are going to be one and the same. We perhaps will be approaching something similar to that in Georgia.

On the point of the annual inspection, we are actually talking like three years, with a different emphasis. I know what the emphasis is now. I know what it was the last time. I can't tell you what it is going to be next time.

MR. LUBENAU: In Pennsylvania, we are weighted by sheer numbers. We have 12,000 machines. In addition, we expect 12 nuclear reactors in the State by 1975. Currently, we have a staff of nine health physicists. There are other areas just in Radiological Health where we must pay attention and, consequently, what we might like to do on a resurvey program, we can't always do. Initially in our inspection program we inspected the dental X-ray units. We then sent a letter to the dentists asking for a 30-day reply, and then we conducted a compliance inspection. It was not a resurvey. If he had been cited for not having so many millimeters of filtration, we would go back to that dentist and reinspect him.

Later the Public Health Service provided filters and collimators which we utilized. About three years ago, we began using the Surpak program for determining compliance of the equipment with the regulations. We found about 85 percent were in compliance, but this was compared to an expected level of 100 percent. We found the causes for the discrepancy to be faulty initial survey or the Surpak was misused or the filters and collimators were misused. We also found a few cases where old equipment had been replaced by new equipment. Then there were cases where we could not explain why the unit was not in compliance.

We haven't really tried to shoot at a given frequency rate for resurveys, simply because we haven't the staff to do it. So we reinspect on a case-by-case basis.

MR. LITTLE: I think this sounds like a very efficient utilization of personnel. I am very much interested in how you determine whether a facility has enough problems to say it warrants an annual inspection.

MR. LUBENAU: Six of our nine health physicists have had graduate experience in radiological health. We put a heavy emphasis on their ability to perform as health physicists and evaluate, not inspect. Consequently, we expect them to make a comment that this facility needs to be resurveyed in the near future. Then that report goes through a reviewer. So it is on a case-by-case basis, relying on the initial evaluation. Provided they reply back, as they are required, that the equipment was corrected, we may not go back to that facility.

We may find another hospital, however, where the equipment meets the literal parts of the regulations. It has the correct filtration and collimation, but they are using second-hand equipment. The darkroom technique is awful. This is not in the regulations, but it will be noted in the survey report, and it may indicate a need to go back soon.

MR. LITTLE: This still sounds like a rather qualitative judgment idea. Do you forsee any possibility of grading a facility on the basis of its potential hazard?

MR. KARP: I think you do this, don't you, at the time of your survey?

MR. LUBENAU: It is done by the inspector. The grading is not in numbers. In other words, I'm not thinking in terms of ten, nine, or eight. The AEC may provide a good example. They have classification priorities. We don't have that formal classification so far as priorities go, but the priorities themselves will be established by the inspector.

MR. PAYNE: Would this type of system be practical?

MR. LUBENAU: I don't know. It's a good point. Has anybody here tried it? How about the Public Health Service? Have they given any thought to this?

MR. MILLER: We have given thought to it and played with it, but haven't come up with anything concrete.

### A County Viewpoint - C Barry Robison[1]

Actually, a resurvey is anything except, to me, the initial determination with compliance. Anything you do, whether it is a comprehensive survey, whether it is an additional inspection or what, is, in a sense, a resurvey, because you're redoing or re-covering old ground.

We have done them all ways. In fact, we did a complete safety survey with the University of Alabama in the summer of 1962 of all dental units in Jefferson County. This included the radiation measurements and adding filtration and collimation when necessary. Again, we did this same thing in 1966, essentially, using the PHS forms rather than the University of Alabama form, and we accomplished the same thing on the dental units, taking measurements and checking the collimation and filtration. You might be interested to know that in the first survey, the dental school reported 108 out of 230 units inspected needed some modification. At that same time, they reported, after their modifications, which were done at the visit, some 90-odd percent were listed as in compliance.

Back in 1966, we did essentially the same resurvey over again, and 148 out of 304 units inspected needed some modification. So you have essentially got the same percentage of people needing some work done on their units. I think that points out that you need to go back.

But it is mainly what Bill Willis said, it is the equipment specifications described in the regulations that we check for compliance and not the "should" items. Our initial survey takes care of the compliance with the regulations as far as equipment operation and equipment conditions.

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[1] Radiological Health Supervisor, Jefferson County Department of Health, Birmingham, Alabama.

The type of resurvey we can do the most of is what we call the "periodic inspection." The last page of this handout has got the simple form we use. If the survey is satisfactory, that means we have a minimum check list. We check all the items that are needed to meet the requirements, and if there has been no change since their compliance survey, we consider it satisfactory.

The tables in the back show that we have about 725 units in Jefferson County. We carry, at present, essentially all of them in compliance, except the ones that haven't been surveyed. Again, we are in the process of reevaluating, going through the medical units, so that there will be some month-to-month changes in this compliance checking.

As for education, the X-ray technicians in a doctor's office, I think that putting on a program for at least the time-being would be an impossibility. We have cosponsored several training courses, as probably many of you have, for chief technicians, put on by the Public Health Service.

Discussion (entire group)

MR. HILTON: It looks to me like you have a very good rate of compliance, particularly on your private physicians. May I ask, do they mainly have new equipment, or how did you get such a good rate of compliance?

MR. ROBISON: We have officially visited all the units in Jefferson County about three times. For many of them we have been back, and back, and "badgered" them to death. In addition, the regulations were originally sponsored by the medical society in Jefferson County. We use this as a lever to push the people into spending their money for compliance by saying this is what your society wants. We have an Advisory Board made up of individuals from the medical society which is functional.

MR. WILLIS: You might point out, perhaps, that one of the reasons we are getting good cooperation from the medical profession in Alabama is the fact that in Alabama the State Board of Health is the Medical Association of Alabama. Every medical man in the State is a member of the State Board of Health.

MR. HILTON: Let me ask you a question regarding collimation. Do you take 22 inches in diameter for a 72-inch chest shot as being the limit of the beam size?

MR. ROBISON: We give him the diagonal plus two inches. Now, on dental, we give him two and three-quarter inches.

Federal Viewpoint - LaVert Seabron, M.S.[1]

First of all, under the concept of the objective, I think the objective of a resurvey program should be the same as the initial survey program. The approach here could be one of education. During the initial survey stage, the emphasis is on equipment, or in most instances, the emphasis is on getting the equipment up to recommended standards. On the resurvey stage -- now, here again, we have to qualify -- we have to go down now to methods of user contact, because in listening to the group here it seems as though things are beginning to fall into two groups: In one instance, we have a resurvey program based only on resurveying units that are in "compliance," that meet your State minimum requirements. This is determined as a result of follow-up inspections or a letter that you have received from the owner of the installation, stating that all the deficiencies have been corrected; on the other hand, I think there is a segment here where the resurvey serves as a follow-up, because from the initial survey, unless you have gotten some written statements from the owner of the installation that your recommendations or your requirements have been met, you have no real way of knowing until you go back, as to whether or not you have been effective in correcting deficiencies and seeing that these deficiencies were corrected. So these are the two points of view as to user contact. In my own instances in New Jersey, where we are dealing with 10,000 machines, we had to establish some sort of inspection priorities.

Now as to your priorities and your frequency of resurvey -- here again, this is going to be based on what you have in the way of money, men and material, to get the job done. Where you're dealing with 800 or 400 machines in one State, you can just about get around and see all these in a year. But where you have 10,000 machines, and I think another thing you have to remember, this is not a static machine situation, there are new units being registered all the time, people are moving all the time, doctors die like everyone else, practices are being sold, so just keeping up with all the machines becomes a problem. This, too, will determine your priorities. Do you establish your priority on the basis of workload? Ideally you would like to get around to all hospitals, all radiologists' offices -- high workload installations you would like to see on an annual basis, and where you have a small number of units, this is probably possible. But when you get into the thousands, ten thousands, 12,000 machines, hospitals of varying size and spread out all over the State, here the matter of priorities becomes very, very important. In our situation in New Jersey, we tried to set everything up on a 5-year cycle. The first year we really got going. We went on a crash program to inspect every installation once. Then we went into a big follow-up phase, to go back and reinspect to bring about compliance. It is really a door bell-ringing job that makes the best headway to get every machine up to the acceptable standards of the State. Now, when we reached the point where our follow-up phase was about two-thirds over and our compliance figures began to go up, we then decided to switch to a 5-year reinspection cycle purely on the basis of manpower available.

We knew from our statistics the number of units that we had in some degree of compliance, but were not in full compliance at the end of December, so when we picked up these hold-over follow-up type inspections, added them onto what we could anticipate in the way of new registration, plus one-fifth of our units that we had placed in compliance 5 years earlier, this gave us a pretty good figure for planning purposes as to what we must do in the next 12 months to stay up with the tide of the units. This permitted us to plan and permitted us to schedule on a 50-week work year.

The first time around, the stress was put on the equipment. We wanted to get all of the equipment up to standard. The second time around, the reception was better. First of all, we were dealing with people who primarily thought that their equipment met all standards. They were in compliance. So when they were called and an appointment was made, there was no pressure on this time. In fact, they were anxious this time to see if there had been any change in 5 years. So since we could spend less time on the equipment phase of the program, we could spend more time on an educational phase. Since the owner of the installation has been relieved of having to spend more money to get the equipment repaired he is now more receptive to an operator education program because this doesn't cost him anything.

So we feel that here, during this phase, (and this is an essential phase of your program) this is probably where you can begin your educational activity. At this point, from this point on, you should find a very receptive audience, from the standpoint of educational activity, because the big thing -- what everyone is usually worried about when they hear you're coming to inspect -- is that you're coming to condemn their equipment and they're going to have to put out several thousand dollars to buy a new unit.

Now, the understanding is that if the owner makes any major change in his equipment status -- for instance, if he purchases new equipment, or if he purchases a new tube, then we came back for that prior to the 5 years. We don't wait 5 years if he buys new equipment during the period, but if we are not advised by him or by the dealers that he has purchased new equipment from the time his equipment goes into compliance, we will not see him for 5 years unless he falls into a high-use category -- that is, a radiologist or a group practice or a hospital. But here, again, the frequency depends on your machine population, and what you have in the way of money and men to get the job done. The general feeling is a reinspection is necessary, because it makes little sense to spend all your effort in getting equipment levels up if you don't go back to keep them up.

When you walk out of a dental office, if you have been using the filters and collimators that are supplied by the Public Health Service, 95 percent of the dental offices' equipment is in compliance, unless there is something wrong with the tube housing or there is something wrong with the timer, which is rare. You won't have to make follow-up surveys on dental installations. It will be your rare dental installation that you will have to make a second visit if you corrected these things on the spot.

This gives you, then, the time to worry about the medical units where the corrections are likely, in some instances, to be major. And here, again, where we feel as though your follow-up activity -- I can't stress that too much because, to me, this is really what makes or breaks a good program -- is how well you follow up the correction of defects that you find on your initial survey, because this has been, I think, the users' determination whether or not you are sincere in what you're doing is how much pressure you bring to bear on them to correct the things that you have found wrong. If you let it go for 4 or 5 years before you come back to see if it has been corrected, the general impression is that it must not have been too bad the first time, or else you wouldn't have waited 5 years to come back to see if it had been corrected.

Discussion (entire group)

DR. COLE: I would like to know if there is any way of finding out the frequency of sale of used equipment. Do you all have any data on that?

MR. SEABRON: In my experience, this is pretty hard to do. We called all the major equipment manufacturers' representatives in when we first got really moving on our program. We then went over our inspection procedure with them. We told them what we were trying to do. At that time, we didn't have it on the books that they had to notify us of a sale or transfer, but we asked them if they would do this voluntarily. To our surprise, 95 percent of them volunteered to send us listings every six months of all sales and transfers. But there is a big traffic between widows selling off pieces of equipment, wanting to give it to the HOPE, or just advertising in the Journal, as you're well aware. We found that there are a couple of "bootleg" outfits. One was based in Florida. They seem to buy up old pieces of equipment, spray them black, put them together and sell them around the country at a very low price.

MR. LITTLE: We, in Washington, D.C., have seen evidence of this type of practice, a company selling stripped-down equipment. It may be new, but it is stripped down and does not meet the national safety standards, nor does it meet our local standards, which are much the same as the national standards. Now, we are trying to caution people about that particular company, but so far we have been unable to do anything other than just tell people about it.

MR. FRY: I think what you're trying to find is the answer to "what is the fate of old equipment." In general, it is used. We have worked out an individual exchange postcard where they notify us on each transfer, and it has not been 100 percent efficient.

MR. ROESSLER: Two comments on the mobile units. Several years ago, when I was active in the business, we found that it was difficult to keep these mobile units in alignment. They drive down the road, set up again, and the beam may be out of alignment. Operators would even trim out the aperture in the lead collimator in order to assure the misaligned beam was large enough to strike the entire screen. Secondly, it is very difficult to control the waiting population when they pull into a shopping center for mass chest X rays.

MR. CLARK: Yes. Since there is no shielding in this aluminum trailer and they are standing near the area, the people are continually exposed.

MR. FETZ: I would like to change the subject just a bit and speak of the Public Health Service survey form and suggest that some modification be made of it to accommodate the fact that on resurveys, you're going to be doing more and more educational work. We should be able to take credit for that, and I think you probably would be interested in that type of information in the future, certainly.

DR. MCDOWELL: I might add, we are in the process of revising this form and will be submitting it to interested parties for comment. A lot of the revision is based upon, or will be based upon an analysis of some 10,000 facilities. There is a report that will be coming out shortly on 5263 medical-type facilities surveyed between 1962 and 1967, in various user categories, such as radiology, internal medicine, pediatrics, general practice, orthopedics, osteopathic clinics, and so on. I want to point out that those people who do use the survey form should take care to fill it our correctly, because the information that comes back to you will only be as good as the information that you put on the form.

## DATA MANAGEMENT

MR. PAYNE: Gentlemen, let us proceed into the final topic of the day. This is the topic of data management. As you know, in an X-ray program, or any program, nothing is more important than the organization of your data and the accuracy of your reports. It does little good to conduct a program without capital data management as a corollary. Mr. Ray Clark, from Florida, will serve as discussion leader, and Bill Graham, from Tennessee, will be an additional speaker.

### Data Management In Florida - Mr. Ulray Clark[1]

Dick, you said it does little good to conduct a program without good data management, and Dr. Miller says that it is a sin to do nothing. Well, we are caught on the horns of this dilemma.

For the last 10 years, we have, in Florida, been surveying X-ray machines. During this time, we have seen a gradual improvement in the status of X-ray machines, although today about 50 percent of the surveys that we make are first-time surveys or original surveys. At the present time, we have approximately 12,000 tubes registered in the State, according to our latest statistics, and they are coming in faster than we can survey them. We have a total of three full-time people, and we did something like 800 tube heads per year for '67 and '66.

Now, this means that it will take us 13 years to get around to all of these X-ray machines. So data management in a program such as ours is pretty important, because we have so few people doing it, and we must somewhere decide how we are going to spend our time. Our three full-time people that I spoke of, also inspect some 500 radioactive materials programs and also they do environmental surveillance work. We have not been able to use automatic data processing like we would like to use it. We have got piles of data but don't have the people to actually carry this through our automatic data processing system, which is in our State Board of Health. We have not been successful, as I say, in this, so we have tried to accumulate our data as the X-ray machine survey comes in. In using this accumulated data, we try to establish a priority system.

Our registration program is updated every 2 years. We get print-outs about once every 6 months from our registration program. In our State, a very fast-growing State, in 6 months this automatic data-processing print-out is then out of date. This is one of our problems that we are going to have to work out.

We started surveying in 1959, as I stated, at the request of a local medical society. They asked us to come in and look at their X-ray machines, so we developed a six-page survey form. After the survey we wrote the physician a two-page letter telling him all about his hand regulator and so forth. Since we were so far behind, we decided that it was time, after 10 years, to go back and take a look at these people to see if they had done anything.

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[1] Public Health Physicist, Division of Radiological Health, Florida State Board of Health.

We selected 60 of these machines that we saw 10 years ago. We were disappointed in finding that about 70 percent had not done the first thing that we had asked them in this long letter. Most of them had copies of the letter. Some said that they never received a report on their machine. In some cases they said, "Well, you told us that this old fluoroscope was no good, and we have quit using it. Now we have brought in this new equipment over here, and we are using it. It was here when you were here the last time, but you didn't make a report on it."

I feel that in Florida we have got to select a discipline such as the private medical man or the osteopath and concentrate our efforts in those areas and hope that in the future we can make some little reduction in this unnecessary exposure.

Discussion (entire group)

MR. BRITAIN: So you have to actually hand-tabulate all of these statistics on your inspection?

MR. CLARK: We have a monthly report that we have found to be more useful right at this moment than automatic data processing. I will say that I have high hopes of getting some simple tables out of automatic data processing within the next several months.

DR. MILLER: Do you record beam size in your current surveys?

MR. CLARK: We have just changed our form, Dr. Miller. I believe it is adequate or inadequate, and we leave that to the judgment of the surveyor.

DR. MILLER: Well, how are you going to relate this to reduction? What if I were to ask in how many of your units was the collimation greater than 48 inches for a standard chest.

MR. CLARK: This, I am not prepared to answer. But I will ask you, what difference does it make right now? Since we are so far behind, we are trying to get the inadequate beams that we do see into compliance, or maybe I miss the significance of it.

DR. MILLER: I'm thinking in terms of assigning a dose value or exposure reduction, a percentage reduction, and exposure to the population of Florida.

MR. BRITAIN: Program evaluation is what he is getting at.

MR. ROESSLER: In 1964, at the APHA meeting in New York, you heard me report on very optimistic plans for a file system. We tried to develop a registration number system that would also carry over to our survey forms. We found out we had to change the PHS dental form, because it didn't use the same number of digits as the medical form did. We even developed paste-on labels to cover up part of the form to convert over to a uniform numbering system. We never did get out of the water on that idea. I still think it is a good idea to have a computing machine file, which would be updated and kept current, and be able to give us a picture, as well as the history, on each machine in the State. I hope someone else has succeeded in this.

## Data Management In Tennessee - J. A. Bill Graham, M.S.S.[1]

In Tennessee, we began our registration program in 1959. At that time we had access to a list belonging to the Board of Healing Arts. This is the list of their licensees throughout the State. They have their list on metal addressograph plates. These plates can be tabbed. The machine which used these plates could be programmed by the use of tabs to print select portions of a list. By that, I mean they were either subject to registration or they were not subject to registration. Now, this worked well; however, not all of our registrants are licensed with the Board of Healing Arts, so we had to get our information elsewhere for those who were not. Also, we wanted easy access to information on the registrants which the tab metal plates could not provide. A few years later, we turned to IBM cards, automatic data processing. We had a long talk with our statistical service section and we were able to design a card to meet our needs. IBM cards not only serve as a list of registrants, but also providing easy access to the type of equipment registered, and the type of facility. Of course, all of this depends on how you design your card. You only have 80 columns to work with, so you have to be very selective. By the use of an IBM 407 Accounting Machine information can be extracted in various forms very readily.

A portion of this register is kept up to date with weekly information from the Board of Healing Arts. Every week we receive a sheet of paper telling us of new licenses which have been issued, licenses which have been revoked, address changes, members who have entered the armed forces, those who have moved out of State, those who have retired, and those who have died. So we immediately send letters to new licensees, to those who have had address changes, to inquire about their registration status. However, this is not as easy as it sounds.

Even with these aids, as mentioned, the registration file, the IBM list, can become fouled, and we know this because just recently it took us about a year to straighten it all out. We now have safeguards built into the system to prevent this from happening again, we hope. We found it very important to have only one person, a health physicist, directing additions to and subtractions from the file.

It is really difficult to keep an accurate file, even with automatic data processing. Our registrants are either unaware of the law or don't care. Our law says that they have to re-register any time there are changes in their facility, like new equipment and other things of that nature. Some additional information is necessary in order to maintain an accurate list. Sometimes we have to make inquiries. Our on-the-spot inspection provides us with a good source of information.

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[1] Assistant Director, Radiological Health Service, Tennessee Department of Public Health.

We can't get any more on this card. Maybe we can go on to a second card. We have thought about selecting one card just for the purpose of addressing mailings.

We have another card for dental X-ray machines. We tied this dental X-ray card to the registrant's card by means of registration number. We plan to use this dental card with our machine to give us statistical data.

We have an accelerated dental inspection program each summer, and we use these cards and select information we want. We print out the machines which need to be inspected. We try to inspect machines every 5 years. This is our present priority system.

Discussion (entire group)

MR. CLARK: Do you have any method of getting a print-out concerning your items of noncompliance on filtration and collimation?

MR. GRAHAM: We can on the dental.

MR. CLARK: Well, can we find beam size?

MR. GRAHAM: We follow the Public Health Service recommended beam size, 3 inches. If it is under 3 inches, we approve it.

MR. CROSBY: I just want to ask you how many X-ray machines you have. What I'm getting at, how many machines does it take on your registration list to make IBM effective or practical?

MR. GRAHAM: We have about 3000 machines, and I don't know what we would do without automatic data processing in keeping up with our registrants. You try going through 2500 folders and extracting information before you begin an X-ray inspection follow-up survey, and you will quickly understand how valuable ADP can be.

MR. CLARK: I think it should prove more, Bill, in our case, since we have got four times the X-ray machines, I feel with these print-outs coming very frequently, and with the proper tables coming out of automatic data processing, it will point out areas that need emphasizing. It should give us an idea on the size of our problem, and I hope that it will bring us some more money one of these days.

MR. KARP: We are going into this process. We started work on that a few months ago to try to go to data processing, but we have one problem: How can we identify these units so that when we go back 4 years from now, the cards that we punch out now for a particular machine will match up years from now? Do you identify these machines in any way? Do you get serial numbers? Serial numbers are hard to get.

MR. CLARK: We used to get serial numbers. I don't know if we have them in our new system or not.

MR. GRAHAM: You notice on the dental card, we do record the serial number. When we make an inspection, we go back to our folders and we have all the previous information on the inspections made. We compare the information in the folder with the new inspection to see if the two agree to make, model, serial number, etc. If they don't agree, we try to find out what happened to this old machine.

MR. CLARK: Now, just how do you get a serial number? A serial number of what? Is it the console, the tube head, or the tube stand?

MR. KARP: You have a tube serial number and a console serial number. The tube housing serial numbers are worthless, because a different type of tube can be put in there. The console number is important, but in many cases the console number is hidden behind the unit.

MR. GRAHAM: This is a good question. I think the tube serial number is the important thing.

MR. CLARK: Is it really necessary to get serial numbers?

MR. KARP: Serial numbers, no. Unit identification, yes. If you wanted to compare the status of the unit, of this inspection, with the status of that same unit 6 years from now --

MR. BRITAIN: But I still don't see the problem. You take your original inspection form back with you so that a comparison can be made.

MR. KARP: That's right, but you might have a GE machine in here this year, and they could have another GE machine in there 6 years from now, and it might be altogether different.

MR. BROWN: This was presented as a hang-up in automatic data processing. Really, and my question is, should serial numbers even be of concern on automatic data processing, because here you're trying to get the overall picture.

I don't question whether or not it would be worthwhile worrying about correlating data on a machine-to-machine basis, but what we want is to alter the attitude and the work that is being done by the doctors or the technicians, hopefully through our educational program. If a new machine is purchased, it will more than likely have the proper filtration. If positive equipment identification is a hang-up in automatic data processing, I just question whether it would be worth the effort.

MR. PAYNE: We have in our group Mr. John Villforth, who has been associated with X-ray programming and has as good an overview of the multiple factors involved in X-ray programming as anyone I know. John.

MR. VILLFORTH: This has been an educational experience for me. I think it becomes very apparent that the kinds of discussions that have been going on here today are absolutely necessary to give uniformity to our future activities. The future activities may come in the form of some aspect of Federal legislation, if H.R. 10790 or some other bill is passed, or they may be involved with premarketing clearance.* The Federal legislation in time might also get involved into such things as licensure of X-ray technologists. Whatever, there is going to be a tremendous need for uniformity and consistancy.

One of the things that the Medical X-ray Advisory Committee, of which Dr. Cole is the new executive secretary, recommended to the National Center for Radiological Health is the need for the collection of uniform State data. They also recommended the Center encourage the States to establish consistent and uniform methods of surveying and reporting of data. I think that some of the activities that we are doing are directed toward these recommendations, and some of the reports which we will be coming out with will shed light on the trends of X-ray use. For example, the report Dr. McDowell mentioned -- the summary of these 5263 surveys -- will be supplemented by additional data from 5000 more surveys.

We have a report on the NCRH recommended registration systems using automatic data processing. This particular report is completed.

I feel that as far as the collection of survey data, using the PHS forms, you should understand that this is not something we are forcing upon you. These forms were designed with the best information and thoughts that we could get at the time. We hope that you will consider modifying it, if necessary, rejecting it, if necessary, or preferably, we would like to see you use it.

There are three kinds of information that we need at the Federal level in the X-ray area. First, we are going to be looking at that basic inventory data, the type of information that comes out in the annual reports regarding compliance, noncompliance, number of machines, etc. The second kind of data is going to be the report of the X-ray surveys -- like the analysis of the 5263 X-ray surveys. This will allow us to look in depth at the variations in survey results with the different kinds of practice.

The third level of data that we will need will be the follow-up to the 1964 X-ray Exposure Survey. This will be a detailed "look-see" at dose, and is scheduled to be conducted in 1970. The results of this study will tell us what effect your programs have had on the reduction in the population exposure.

All of these levels play important but different roles. I don't think we want to leave you with the impression that we insist that you collect survey information on PHS forms.

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*On October 18, 1968, "Radiation Control for Health and Safety Act of 1968" became Public Law 90-602.

**MR. WILLIS:** At the State level at least I try to orient our program in such a way that our primary mission is to reduce the exposure to the public to radiation. Now, how much manpower should we divert from this task to go into an elaborate data-processing system which does not in any way reduce the exposure to the public. That is the compromise that all States are having to look into, particularly where you're not as fortunate as we are in Alabama to have a rather adequately staffed program, but where you have a one- or two-man program.

**MR. VILLFORTH:** I think we have to be careful that we don't force a State into a situation like this. This could be collecting data for data's sake. I don't think we want any part of it. What you should always keep in mind is that as States get into comprehensive health planning, there may be a need for some of this data for your own State programs in addition to what we might need for our programs.

**MR. WILLIS:** We certainly need a minimal amount of data to justify our own programs under this comprehensive health planning.

**MR. VILLFORTH:** I think that we have not adequately used the data we have available. Certainly, we have been guilty of not reporting out the results of the data that we collected from you over the years. This is one of the biggest complaints that we have received. Some of the States have been pouring data to us for as much as 5 years with essentially a zero output from us, and I don't think we can impose any more on you without getting hard copies back to you to give you some indication of priorities and needs.

## DISCUSSION OF SHORT TERM TECHNICIAN SCHOOLS

**MR. PAYNE:** We have the people in this particular part of the country who have been involved with short term technician schools. What I have reference to are medical technologists' schools. They have a 6-month curriculum with a smattering of X-ray training. We are a little concerned about them because we feel the training, particularly in the X-ray area, is below par.

**MR. GRAHAM:** We have one of these schools in Nashville. This school has come out with an advertisement in the paper suggesting that schools in Nashville connected with Vanderbilt and other hospitals are too long and recommends to students to come and get their education in a hurry and get out and get to work. We visited this school, and they were using students as patients, X-raying them. We just simply told them, "Well, you're not to do this any longer. If you want to make X-rays, then buy phantoms." They said they would stop. This was about a year ago when we made this visit, and we plan to go back very shortly, because of all this attention that has been recently given to this type of school.

**MR. ROBISON:** There is one of these schools in Birmingham. We went down there when they first opened and tried to get some information from them.

They didn't have any. We finally went back and they had a vertical fluoroscope. We told them, "You can't operate that thing here. You can't use patients. There is no shielding in the wall." We didn't like the idea in the first place. Well, we cut the plug off and tagged it so they can't operate it. That's compliance, but I think it is still in the paper, being advertised as turning out X-ray technicians, among other things, in 6 months.

MR. RUSSEY: May I add one thing to that? In their advertisement, they advertised, "X-ray technician." After our visit, they are now changing to "X-ray technique." They don't use the word "technician" in the Birmingham papers.

The darkroom equipment is just some second-hand junk, and it is placed over in the corner of the room. They have one operator's protective shield. That's the only thing that they had to ward off X-ray radiation should the machine be energized. There is a vertical fluoroscope with a self-contained head that can be swung out over a horizontal table that is positioned in the rear of the fluoroscope.

MR. KARP: In Atlanta, one school advertised in the paper as being a school of X-ray technology. This advertisement was collected about a month ago, but we haven't had a chance to go and check on them. But the other school, we have checked. They have been in Atlanta for well over a year. This one is a little different. They don't train X-ray technologists, as such. They call their graduates medical assistants or dental assistants, etc. Actually, they teach secretarial work, bookkeeping, button-pushing, blood tests, etc. From the name of the school, you might think that they are training medical technicians, etc. In their advertisement for the X-ray program, they are shooting a student for a patient, which they did, until we talked to them. They use a wash-tub collimator. The technician stands on the wrong side of the protective shield; and they have another student in the room observing. My question is, what can we do about something like this?

MR. LITTLE: License your X-ray technicians.

MR. KARP: Fine, this is good, but right now we don't have licensing. These people do internship at local physicians' offices, and these are the people that hire them; someone who just needs a secretary or a receptionist who can take an X-ray now and then. That's where the demand for these people is, and there may be a place for this type of person.

MR. WILLIS: I am not advocating lowering the standards on X-ray technicians, but until we get something like licensure that we can enforce, I don't think that there is a lot we can do. May be these people are actually doing a service in some areas. Is it better to have 10 hours of training or no hours of training before you push the buttons, if the training is anything reasonable?

MR. KARP: Even with licensure, there's still going to be a demand for this type of person. A dentist is not going to hire a qualified technician. He will hire a secretary or receptionist that can push a button. So if he can hire one of these people who has had a little experience, we may be better off.

DR. MILLER: I think you're coming around to how much training or knowledge in X-ray fundamentals is necessary before you can operate a piece of X-ray equipment safely, and maybe this is what you should address yourselves to.

MR. WILLIS: This is really licensure.

MR. BRITTON: I think the point of discussion here is the quality of education of these particular students. Henry also hit on the point that a student technician might be trained without ever pushing a button at one of these schools. I think if we improve the quality of the teacher and bring this quality up to a certain standard, some technicians with 10 hours of training would have adequate qualifications.

DR. MCDOWELL: When you say "standard," are you talking about these priority schools, AMA or approved schools for technician training?

MR. BRITTON: I think we are talking about all schools in general. I think the school may have to be divided into (1) schools that are turning out registered technicians and technologists, and (2) schools that are turning out medical assistants.

MR. FROOM: In California, there are a number of medical assistant and dental assistant X-ray training schools, and there the State Health Department is attempting to work with these schools in raising their standards in X-ray protection.

MR. KARP: We have given about eight hours of lectures to these students in Georgia, because we feel that anything we can do to help these people will be an improvement. So we might say we are working with them to a degree, also.

MR. PAYNE: I think one effect, at least in Georgia, seems to be stimulation in interest in licensure on the part of some of the X-ray technicians. I don't know if this thinking is widespread, but certainly, in Georgia, this has been one of the immediate effects.

## SURVEYOR QUALIFICATIONS

MR. PAYNE: As we proceed into this next topic we shall try to determine what qualifications a surveyor must have to perform the various phases of X-ray facility surveys. We shall hear from Joel Lubenau and Bill Graham.

### Surveyor Qualifications In Pennsylvania - Joel O. Lubenau, M.S.[1]

In 1937 we did our first survey of any kind in radiation protection, and the surveys were conducted by industrial hygiene engineers. We don't have any record of their specific training or experience in radiation protection. We do know they were sufficiently qualified to perform a radiation survey, using a specially made Geiger counter because at that time none were available commercially, and their surveys included whole body determinations of radium in the female workers. This was performed by observing the count rates when the probe was passed over the bodies of freshly showered female employees.

In 1956, a health physicist joined our staff. These people were supplemented by U.S. Public Health Service COSTEPS and State Assignees. Since 1964, the radiation control program, for the most part, has been carried out by people in the health physicist classification.

During the last 31 years we have had quite a variety of personnel involved in our program. These included industrial hygienists, dentists, and physicians, summer workers - usually schoolteachers, summer college students, PHS COSTEPS, PHS State Assignees, X-ray technicians, vocational high school students, and health physicists. The training that has been provided to these people has included graduate studies, short-term courses provided by the Public Health Service and the U.S. Atomic Energy Commission, and, of course, in-house instruction. It is interesting to note that in the year the health physicist classification was created, the first round inspection for compliance reached a level of 80 percent. The number itself isn't important, but what was important at that time was a shift in our emphasis from concern for occupational radiation exposure to the total impact of radiation upon the public. We decided to reorient our inspection program from a simple regulatory compliance inspection to a radiation protection evaluation.

We have found a problem recently in our accelerator inspections, one which applies to all uses of radiation, and that is an increased need to evaluate people, as well as the machines. We have also found that there are deficiencies in our own regulations, and one of the best methods we have for spotting these deficiencies is to have capable people in this field, capable of evaluating the radiation situation, rather than doing the simple inspection.

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[1] Radiation Health Physicist, Radiological Health Section, Pennsylvania Department of Health.

Recently, Ralph Nader quoted K. Z. Morgan's recommendation that such equipment be surveyed by certified health physicists. In contrast, Aamand Brodeur and Ed Seagle, in 1964, found that a PHS-trained demonstration team and a team of sanitarians with two weeks of PHS training, performed the best survey. I think there is a role for both types of individuals on the survey program.

## Surveyor Qualifications In Tennessee - J. S. Bill Graham, M.S.S.[1]

We in Tennessee haven't been able to interest the radiation physicist or the health physicist in a steady diet of routine X-ray surveys. To date, we have not employed X-ray technicians, but we may consider this in the near future.

Several years ago when we were involved in a crash program to get filters and collimators into X-ray machines, we employed high school science teachers during the summer months. We specified that they have a math, physics, chemistry or engineering background. We felt the teachers with these backgrounds and with a short period of training would adapt rapidly to our inspection program. Also, we were able to persuade our Personnel Department to set salaries high enough to interest them in summer work.

These people are not able to carry out a broad educational program with their surveys. After all, we only have them with us about 10 weeks, and we can't afford to take too much of this time in preparing them to make surveys. But they do bring back the answers we want, and they do put filters and collimators in the machines. They also make scatter radiation measurements and demonstrate to the technician, the physician, or the dentist, such things as the difference in radiation levels inside the room and radiation outside the room.

For several years we had COSTEP students assigned to our program by the Public Health Service, and they worked side by side with the teachers. We provided training and supervised field work for the teachers. The Public Health Service had already prepared the COSTEPS with this background before assigning them to the States. We may now consider hiring X-ray technicians full time. If so, we will provide them with whatever further training they may need to carry on an educational program along with their routine inspections.

The foregoing should not imply that all X-ray surveys in Tennessee to date have been made by summer employees. These people have not been used to inspect radiologists, large hospitals or radiation therapy installations. These surveys have been made by our own regular staff.

I do agree that once a State has passed the stage where mechanical or most mechanical corrections have been made in X-ray facilities, it is time to get busy with the educational approach. Of course, we all realize that both of these should be done together, if possible, but it just was not possible in Tennessee because of a limited staff.

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[1] Assistant Director, Radiological Health Service, Tennessee Department of Public Health.

Discussion (entire group)

MR. LUBENAU: There is a continuing need for both the qualified physicist and the summer worker. Just picking COSTEPS, we can expect continuance of 5 to 10 percent of our sources not having been surveyed simply because of the turnover of equipment. For us, that represents, in numbers, about 1200 machines. We have summer workers, schoolteachers, who are given some intensive short-term training by us and then are sent out to inspect, and they have been very valuable. In fact, a couple of them have stayed over and have become permanent staff members.

MR. BRADBERRY: In what area do these people primarily work?

MR. LUBENAU: In our case, primarily in the dental surveys.

MR. GRAHAM: We start them out in the dental field, but some of these teachers have come back with us year after year, and we have gradually worked them into the medical field.

MR. BRITTON: What do you consider a qualified person?

MR. LUBENAU: We have three breakdowns. The associate position is essentially a person with a Bachelor's Degree in either engineering or one of the sciences. The Radiation Health Physicist I is someone with graduate school experience in radiological health, and the II position is the I position plus experience. Now, we have been providing our associates with either U.S. Public Health Service training or the Oak Ridge 10-week course.

MR. GRAHAM: We have four positions entitled Radiological Physicist, One, Two, Three, and Four. One and Two require a Bachelor's Degree. Of course, the first position requires some experience along with a Bachelor's Degree in one of the physical sciences. Now, this is where we draw the line. If a man doesn't have experience, we require that he have a Bachelor's Degree in physics. But if he does have experience, if he has worked at one of the atomic facilities, and he has varied experience in radiological health, health physics, then we will accept another degree along with his experience. But to go beyond Grades One and Two does require a Master's Degree in one of the allied sciences.

MR. BRITTON: Can you substitute so many years of experience for his Master's Degree?

MR. GRAHAM: No. The State is very accommodating by sending a person off to school and paying him a salary, providing he will come back to work for Tennessee.

MR. BRITAIN: Has anyone been able to utilize these 2-year schools in radiological health technology? We have just hired a man, and his credentials look pretty good, for an inspector. I just thought you ought to know that these places exist and graduate a 2-year degree person in radiological health technology.

**DR. ROESSLER:** The Public Health Service-sponsored junior college programs in radiological health technology should be considered as possible sources of X-ray survey technicians. I really can't speak authoritatively for any of these programs but I am somewhat acquainted with the program at Central Florida Junior College. These students are receiving instruction in survey instruments, laboratory techniques, electronics, radiological health terminology, and radiological health practice. They should be very easily trainable as X-ray survey people. They, also, I think, have a certain amount of attention paid to report writing and math. They spend one day a week, during at least one quarter, at the University of Florida in the various radiation control health laboratories. Here they spend time with the health physics technicians at the reactor, and the health physics technicians visiting the other areas, and they spend some time in environmental engineering labs doing radioactive analyses. So they get a broad spectrum of radiological health background. There would be a problem perhaps with the age. They go immediately into the program, and thus at graduation they are two years out of high school. Now, this might be a disadvantage to going out and talking with the physicians.

I suspect that if someone could show that there was a market for these individuals on completion of the program, the people at Central Florida, at least, might be willing to include almost anything in the curriculum, even a specific X-ray survey course, if this is what you want. The problem in the past has been that there have not been positions, job classifications, in health department programs that would accept these people and still pay a sufficiently high salary to compete with industry.

**MR. WILLIS:** I would just make the point that we have two registered X-ray technicians on our staff as inspectors for X-ray units. We use these men across-the-board for inspection of all units, whether they be dental, medical, hospital or whatever. But this is for physical compliance only. We do have health physicists assigned who can back these X-ray technicians if they get into a situation they can't handle. Thus far, it has worked out extremely well. Incidentally, these people, in addition to their academic training, have had short courses such as the basic occupational radiation protection course and the medical X-ray course provided by the Public Health Service in addition to the experience of going out with some of our inspectors. We find that the technologists' society is fairly closed, and we hope that when we get into the educational aspect of the program, that perhaps these people may have the ear of the technicians a little bit more than the health physicist would.

**MR. CROSBY:** Has anybody considered hiring chief X-ray technicians and paying them enough to get them away from the hospital? This sounds like also a pretty good type of person to have on your program.

**MR. LUBENAU:** I gather no.

**MR. ROBISON:** I believe Dr. Brown at the University of Georgia was developing a special program to utilize X-ray technicians to give them an opportunity to advance up the ladder.

MR. FETZ: I wanted to ask Ray Clark if he could comment to some extent on the use of sanitarians at the county level on X-ray inspections.

MR. CLARK: We have two sanitarians who have attended the 10-week Oak Ridge course. We have been fortunate, but as a generalization, I would not say that it would work out satisfactorily on the county level.

DR. ROESSLER: I don't think you have ever been able to count on these sanitarians being able to regularly devote time to X-ray work on a one-week-a-month basis.

MR. CLARK: Bill Graham hit the thing on the head a while ago. You can't get a man to do surveys on X-ray machines day in and day out if he has any broad background. It's a little too confining for him. He would like to do some installation work in addition to these X-rays, or perhaps radioactive material surveys to vary his experience. The work becomes boring to him.

MR. VILLFORTH: I want to make an observation about Mr. Ralph Nader's comments, and I think that this is important. Dr. K. Z. Morgan's statement in the proceedings of the hearing of the Senate Committee on Commerce on S. 2067, which Mr. Nader quoted in the May 1968 issue of "Ladies Home Journal" is as follows:

> "State authorities should inspect all medical X-ray and radioisotope facilities at least once every 6 months. Each inspection is to be made by properly qualified (certified) health physicists."

Now, with about 400 certified health physicists and roughly 224,000 X-ray machines it comes out that each certified health physicist is going to have to service about two machines a day. That doesn't leave too much time for other things. And there's a possibility that he may get bored just doing inspections.

MR. WHATLEY: The X-ray technicians in our State have regional meetings for their society. Our two technicians that work with us go to these meetings and talk to the technicians and associate with them. We have found that in every hospital we have been in, these boys are known, and they come in on a friendly basis. We have found that they have done a real good job. The hospital administrators and technicians, especially, have been very receptive to these type people.

MR. FETZ: I would like to ask whether or not different qualifications can exist in the first survey and a second survey in the personnel area.

MR. CLARK: We have tried to use this county sanitarian, that you referred to, to go back and make our brief follow-up survey with a pencil and a piece of paper.

MR. BRITTON: How does the sanitarian know that he put in the correct filtration or know that the cone that was originally there is not the one that is still on. Now, does this man with the check list serve any useful purpose?

MR. CLARK: I think the man going back there and facing the doctor, asking him what he has done, has a lot of value.

MR. BRITTON: We found out, in Georgia, that many times there has been noncompliance in our original survey, and the only way we found this out was by doing another survey. Now, if your philosophy is that you are going to do this next year, do a resurvey with a pencil, and the following year do an actual physical survey, well, you have shot patients for an extra year without even worrying about whether or not you have corrected anything.

MR. CLARK: Ted, I do believe that we are gaining something by sending in a man with a pencil and piece of paper. We wouldn't have been in there at all without him. This shows the doctor that we are still interested.

MR. KARP: I agree with your philosophy. We have tried that in one county around Savannah, and it works very well. A local sanitarian goes back and badgers, and then he can keep us informed as to the progress.

MR. FROOM: Would it be too costly to use two people on a survey team? One of these people could be a technician, the other could be a trained X-ray technician, or health physicist, perhaps. The technician could do the physical aspect of the survey, while the health physicist could be discussing some of the educational aspects. You could probably do a survey in less time this way and utilize two people covering the educational aspects and machine deficiencies.

MR. LUBENAU: This goes back to an old question. It must be as old as the problem itself, as to whether you send one or two people on a survey. Which is more efficient?

MR. RUSSEY: Two are more efficient.

MR. LUBENAU: We have already had one person - two - now three - that are saying two are better. For one State's experience, we normally send one person out. There are advantages just of the type you mention where two people can do the job better, not always quicker, but certainly better than one person. This is particularly true of larger installations. Of course, we have the numbers problem. In our view, to do the job the best way with what we have got, we feel we should have one individual to go on the survey, not two.

# SURVEY OF CHIROPRACTORS

Mr. Richard M. Fry, M.P.H.[1]

We have an excellent working relationship with our Kentucky State Board of Chiropractors, which is not the Board of Health, obviously. There is no Board of Healing Arts, as someone else has referred to. They are two distinct, separate boards. From the beginning, when our program was being set up, we worked with the various professional societies to get the support for our program. We went to the Chiropractic Board and it was their attorney who helped us get our bill passed, because here was a place where the two could work together in a cooperative program, and it worked. Now, it would have been difficult if we had had to meet their board with our board. We realize this, but their executive secretary and our radiological health director have always had a working relationship.

They have field inspectors who do a chiropractic field inspection. These are chiropractors who take one day a week off and for a minimum fee go around and check on a number of chiropractic standards. While there, they look at some obvious things, such as operator shields, cones, filters, not to check and see if the cones are exactly the right size, or the shield is the right thickness, but that the man has these accessories. We have worked with these inspectors -- we make it a point when we have a surveyor in that region to try to make contact with that man to do a very thorough inspection of his X-ray machine, so he can watch how close you really go over one of them.

Keeping up with all of the incoming and outgoing chiropractors is handled by their board. They use our registration form and get it filled out. We work with them on compliance matters too. We haven't taken legal action against anybody yet. Obviously, we would go to county medical societies and State chiropractic boards to get compliance first.

I realize in many States you have a different operation altogether. I have stayed off of the conflict about what the chiropractor is doing with the machine, and what his qualifications are. From the health physics standpoint, they have served us well in a working relationship to get the type of compliance and good practice as a result. They enjoy some of the highest compliance ratios. Their equipment is old, but most of it is pretty simple since they are not doing very complicated procedures. Many of them take the single-size shot and, therefore, they can have complete collimation, for example. But in dealing with these individuals and making surveys of chiropractic offices, I feel that the surveyor must pursue an educational aspect of his program, and in doing so, you need an individual who can deal with these people as a specialist in the health physics field, as they consider themselves specialists in their field. Using the survey team approach with these individuals we have two people who have a greater resource of information to discuss with the individual and have a higher probability of being able to answer all of his questions.

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[1] Director, Radiological Health Program, Kentucky Department of Health.

Discussion (entire group)

**MR. KARP:** Dick, we had this same set up in Georgia. Chiropractors would go around and survey each other, get the place in pretty good shape, then we would go behind them and check it. By and large, they had a very good compliance ratio. If we could handle everybody like this, we wouldn't have too much of a problem.

**MR. WILLIS:** In Alabama we have a little bit different situation in that the chiropractors are all licensed by the Healing Arts Board, so consequently, the chiropractors are inspected just like any other unit. We have had no trouble at all in getting compliance from chiropractors. You tell them what is wrong, and they usually fix it right away.

**MR. FRY:** I did not speak to the point of surveys of chiropractors. To me, you obviously survey a chiropractor's radiographic unit just like any other.

**MR. DEROSE:** I have some observations that I made through personally surveying over 100 chiropractors. They all try to work with us. They have gone ahead, and as you said, cleaned up their own house and did a good job within their limitations. However, to suppose that their collimation, film sizes of distance requirements are the same is wrong. They don't use one film size. They have a minimum, most of them, of at least two film sizes, and they use several distances; 36-inch, 42- and 60-inch distances. You have a big problem in just collimation when you survey chiropractors. You have got to make sure of their shielding requirements.

**MR. FRY:** How different is this from any medical facility? They shoot at different distances.

**MR. DEROSE:** Your comment was that they usually have fixed conditions of one film size, so you don't have to worry about collimation?

**MR. FRY:** Many of ours do, the 14 by 36 is an uncommon procedure in Kentucky.

# SURVEYS OF VETERINARIANS

J. Edward Cowan, M.S.P.H.[1]

Once the decision was made to do a State-wide survey of our veterinarian X-ray units, the first thing we did was to sit down and decide why we were doing this. In addition to that, we asked ourselves, if we were successful, what would be accomplished? So, we arrived at four objectives. We felt that if we could fulfill these, it would be a successful program.

First of all, we didn't know the location and number of units involved. We wanted to register the units. To accomplish this, we used a very simple registration form (the postcard type) to say, "I have a unit"; or, "I do not have a unit." The veterinarian signs it, and we tabulate the results.

If you would follow the pass-out form, you will see that these veterinarians were a little bit reluctant in registering the units. But, we were persistent. We kept sending them the cards and they kept dribbling back a small percentage each time. After three cards, in about 3 or 5 months, we had 44 remaining who absolutely refused to send a card; so, we contacted these people by telephone.

The second objective was to perform an inspection of these facilities. The third objective, then, was to determine the compliance status of all the units. This would be done by comparing the inspection results with those applicable provisions in our regulations. The fourth objective was to follow up on these and to bring them into full compliance with our regulations.

The inspections were performed by our two registered X-ray technicians who had 2 years' prior experience in survey techniques, and each had 8 weeks of Public Health Service courses; so, they were very well qualified. We found that over half the units had no filtration which was inserted at the time of the inspection. A very small percentage of the units were not adequately collimated.

One other item I did want to mention was what we found at ten of these places; they did not use lead aprons and gloves while holding the animals -- which is a requirement.

## Discussion (entire group)

MR. BRADBERRY: In the hand-out you have the use of hand-held fluoroscopes. How do these veterinarians hold it in the primary beam? You can't hold your hand steady that long. The second part of this question is what determines compliance or noncompliance with this hand-held fluoroscope?

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[1] Compliance and Control Program, Bureau of Radiological Health, U.S. Public Health Service (previously on State assignment to Alabama Department of Public Health).

**MR. COWAN:** He is not supposed to have it in the first place, so we didn't even get into how to use it. We only found one hand-held fluoroscope. As a matter of fact, he gave it to us.

**MR. LUBENAU:** Ed, how did you locate the veterinarians in order to register them?

**MR. COWAN:** We have a directory of all the licensed veterinarians in the State of Alabama, and we simply used that as a mailing list.

Shielding and personnel monitoring are tied in very closely with the workload. We found the workload was low. I believe, if my figures are correct, that about 40 percent of them took one exposure a week, and about 75 percent of them had three exposures or less per week. So we are talking about nothing, as far as the workload goes. And for all 66 units, we have one industrial X-ray unit, one unit that has a larger workload per week than all of the veterinarian units combined. So largely, because of the low workload factor, personnel monitoring was all right and shielding was all right, except I think in one case.

**MR. FUENTE:** Ed, this question of holding animals and not wearing lead aprons and gloves, is this one of these questions where you ask the veterinarian if he uses lead gloves and aprons, yes or no?

**MR. COWAN:** Yes, that's exactly the way we determine it. You're almost stuck with that method. That comes under operating procedures, and we simply asked them. Of course, they didn't have to be honest about it if they didn't want to.

**MR. LITTLE:** I presume your shielding requirement is on the basis of existing workload.

**MR. COWAN:** It follows Handbook 76.

**MR. LITTLE:** But on the basis of workload, existing workload? Or is it classified as a busy facility or what?

**MR. COWAN:** We used existing workload. So the summation is that we did perform this survey. They are almost in 100 percent compliance. And compliance as I use it, means that they are in full compliance with the requirements of our regulations that pertain to vets.

We had a little difficulty in getting them to register units, but after that, there was simply no difficulty. We were well received and followed up the inspection with letters. They notified us by postcard when the corrections were made. We verified each correction by a follow-up visit. Now, as a result of this survey, I would have to place the inspection of veterinarian X-ray facilities in a low priority category.

**MR. CROSBY:** Did you find that they were using mostly the second-hand equipment?

MR. COWAN: Well, most of it is portable, but it is portable in a stationary position.

MR. CROSBY: This cast-off equipment is what I'm talking about, rebuilt and things of this nature.

MR. COWAN: I think really if you would go over your requirements one by one, you would find that the age is pretty much irrelevant. An old unit can have the proper filtration, proper collimator and timer.

MR. FRY: A point you haven't touched on, which may be unique to Kentucky, that we find with veterinarians in the large animal work with horses is the shooting of grooms. They hold the cassettes during the exposure. A tube stand and a cassette holder are generally not used. The horses are very expensive and are well cared for, and the grooms are not aware of or alerted to X-ray safety.

MR. LUBENAU: Have you found any using radioactive material?

MR. WILLIS: At the vet schools at Auburn, they are using some radioactive material. This is in the school, not a practicing veterinarian. They are using some radioactive material for therapy work.

MR. KARP: They are using a little at the University of Georgia. They have just designed a building and lab for this. They also use X-ray therapy at the university of 250 kVp and 150 kVp.

# SURVEYS AS PART OF THE MEDICAL CARE CERTIFICATION PROGRAM

Richard H. Fetz, M.S.[1]

First of all, I will ask people to raise their hands that haven't an active involvement in Medicare. (Several hands were raised.) We do have an active involvement. As you know, the Medicare Program is a year or so old, and we were asked a number of months ago if we couldn't actively participate in this program and provide our area of specialization within the Medicare field.

For those of you who haven't had an opportunity to participate in Medicare, let me say that they have got a little "Bible," HIM-1, "Conditions of Participation of Hospitals." This booklet enumerates some 25 conditions of participation for a hospital to be able to be associated with the Medicare Program. Condition Number 10 deals with the Radiology Department. On this page, it states that there are four basic standards, Standards A, B, C, and D, that deal with the use of radiation, X-ray, etc. Standard B deals specifically with an area of interest to us, and it says, in essence, "The Radiology Department is free of hazards for patients and personnel." Under Standard B, there are four factors which are enumerated. These factors say that inspection is made by local or State health authorities or a radiation physicist. This is where we fit into the picture. We were asked by the medical facilities section or our health department to do the inspection work in the X-ray Department, and this we have been able to carry out for them.

We have treated these particular inspections just like we would any others. They have been considered in the light of our existing standards, which are identical with the standards we would use in any other hospital whether it is Medicare associated or not. At the completion of our inspection, we submit to the licensure section of our health department a copy of our report, and on that we enumerate the areas of noncompliance, and they take it from there.

We submitted to the regional office of the Social Security Administration the Form 1539 on which our licensure people indicate whether or not Item 10 was in compliance or noncompliance. I think the liaison that we have had with these people in our State has been excellent. We get a prompt notification of when an inspection is due, and we have been able to keep up with their frequency schedule. For the benefit of those who aren't familiar with it, there are some hospitals that are JCAH accredited that we might see every 24 months. There are some of them that are in substantial compliance with one or more of the 25 items. And we might see this hospital, this particular type hospital, every 18 months. Those hospitals that are in so-called Category 7(c), we would see, if they had a defective X-ray condition, once every 12 months.

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[1] Director, Radiological Health Service, Georgia Department of Public Health.

Discussion (entire group)

MR. FUENTE: Since we are on this Medicare program, our Medicare personnel recently asked us if we knew of any situation in our State where portable X-ray units were being taken into homes for X-rays. We knew of none, and after calling all our X-ray service companies in Jackson, we determined they knew of none. This situation could arise, however, and Medicare would pay for this service.

MR. LUBENAU: We also had that question asked of us by our medicare people, and we did have such a company. Their interest was the company's compliance with existing State regulations. We checked our file and determined that there was only one individual in the State providing this sort of service, and he had been inspected.

MR. CLARK: We have three in our State, Dick, and the equipment is just as safe as that new portable equipment hospitals use on the various floors.
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MR. CROSBY: What kind of machine would they use? It would have to be pretty light-weight wouldn't it?

MR. LITTLE: They have portable machines now that weigh about 29 or 30 pounds.

MR. WILLIS: In regard to this portability of X-ray units, I think we have all seen these Japanese units of 15 milliamps and 65 kVp that are about 8- by 4- by 8-inches, and quite portable. The ability of this unit leaves a lot to be desired, but I expect this will be the type of equipment that will be used in the future. This may present a problem to us in knowing just where the X-ray unit is. You can pick it up and carry it off, and it could be quite hazardous to someone not acquainted with X-ray protection.

MR. FETZ: Has anyone been able to deny Medicare certifications based upon an X-ray deficiency alone?

MR. FRY: The certification people in Kentucky expect the user to have 100 percent compliance on every item with our regulations.

MR. FETZ: Was Medicare certification based on X-ray alone?

MR. FRY: Delayed, but not denied. The form has got the words "substantial compliance," and I have yet to be able to find a clear definition of what "substantial compliance" is.

## COMPLIANCE

William G. Crosby, M.P.H.[1]

To me, really, the question is not whether it is compliance or noncompliance, but what are the standards against which you measure this compliance? This varies, and I think interpretations are almost as many as we have people here, and I know mine. Most of my own feelings about this are colored, of course, by the philosophy of my own Health Department. It has been a missionary program. Now, we come into the type program -- and we are just getting into it -- of a regulatory nature. And I think we will have to alter our philosophy to some degree if we are going to measure against a set of written standards, but I hope that we never get into the position where there is not some latitude allowed for independent judgment.

I think I remember an example where this would apply at a meeting on Medicare that we had to see how we were going to work with the Medicare people. We came across some really laughable -- they would be laughable if they weren't so serious -- situations wherein compliance was not granted by virtue of lack of film badges on personnel whose hospital had one of the lowest workloads I have ever heard of -- I think about two a month. Surely this must have been some specialty-type hospital, but nonetheless, a film badge was just stage dressing in a situation such as this, or at least the absolute firm requirement that film badge be stuck on everybody's shirt pocket when, in fact, the "use" factor, or the "work" factor was extremely low.

This is what I mean, then, by allowing latitude for independent judgment. We are being pressed, however, more and more into using the lawbook approach. I don't think I personally could ever operate in such an atmosphere. I notice that this is not only true in radiation protection, but it is becoming more and more a way of life in almost every field of public health, and maybe this is the way it has to be ultimately, but I will say one thing - if you're going to operate a police-type program, you'd better have a police force. And I don't think we can envision this size force. So, I think we will still go on carrying our missionary's torch as much as we can.

Then compliance to me would mean substantial agreement with the standards that we advocate, but allowing this latitude for judgment in situations.

Discussion (entire group)

MR. FETZ: What is compliance in Kentucky?

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[1] Chief, Radiological and Air Pollution Sections, South Carolina Board of Health.

MR. FRY: Well, we would go back to why we use a professional health physics-trained individual. He makes a field determination that this is compliance. Yes, we sit down in the office and try to get some agreement. If you think the different States have different disagreements about what is compliance, get six of our people together and you will find out there're five different reasons.

MR. CROSBY: This, of course, is the pitfall in using judgment, but nonetheless, you have to rely somewhere on someone's judgment. Regulations are written with this incorporated, and I always go back to septic tank regulations and things of this nature, which state that they are in agreement with good engineering "judgment."

MR. WILLIS: You have got to make some kind of evaluation of the situation in many of these cases, and where the regulations just do not fit a situation, it is fruitless to try to twist them into it. This is why the health departments have traditionally tried to maintain high standards of professional people. Otherwise, you don't need them. You need a check-sheet type of thing. I think this is the whole justification. We are at the point where we are required to make perhaps more police actions than we have in the past.

MR. BROWN: I think everyone agrees that there are regulations written for general conditions and there are, in fact, physicians or dentists using a machine in such a way that certain regulations that technically do apply are really not applicable. What you're saying is that you don't want to tell a doctor that he has to do thus and so, when it is ridiculous and it is something that is of no radiological health value.

MR. CROSBY: Absolutely. That's what I mean.

MR. BROWN: I don't know how other people are approaching this, but with some of these requirements that can or can't be applicable in certain cases, we have taken almost a licensing approach on the registration certificate. We actually will modify the registration form based on the statement that he did thus and so, to indicate he is exempt from this requirement. I think you need the regulations to be firm. As was said, we have, hopefully, reasonably intelligent people and need them in the program. We do have the latitude or the ability to exempt someone from a ridiculous requirement, even though the law is quite firm.

MR. LITTLE: I personally feel that this question of compliance is extremely important, and it is just as important for States to have uniform compliance procedures as it is for them to have uniform regulations. All of the States could have exactly the same regulations, but I believe there is a growing and ever-increasing disparity in the degree to which the States require compliance with these standards. This is why it is an important point with me, that some group is not taking action in this area to developing guidelines for States so that they can begin to apply regulations with uniformity. I would like to suggest that the NCRH should work with a group of States to perhaps form a committee for this purpose. Just as the Council of State Governments has a committee that has developed uniform regulations, there could also be a committee to develop uniform guidelines for compliance and measuring the degree to which a facility is deficient.

**MR. FETZ:** In the compliance area, we have seen the Atomic Energy Commission operate for years. We go with them all the time. There is a great amount of difference in the way each individual inspector looks upon compliance within the framework of that license.

**MR. LITTLE:** I'm quite sure that there is always going to be this judgment element. But I believe it would be advantageous to all of us to strive for more uniformity in measuring compliance.

**MR. BROWN:** To bring up the point of legal action, I would be interested to know how other States would handle various delicate situations. One such situation might be a doctor stating, "I am right and I will not do what the law says I shall do." I'm sure it is bound to happen. I know for us, it tended to take somewhat of a devious course. I find that we end up with conferences, very casual threats, stronger threats, and so on. I don't know if we go for ten years with a person in a situation like this and hope he will give up some day or what.

**MR. SEABRON:** Most codes are such that exemptions can be granted. I'd like to describe how New Jersey handled the problem of dealing with a person who had been practicing this procedure for 25 years and felt that he should not have to be forced to comply with this section of the code. When our letters didn't get immediate results, we sent him a letter requesting that he put in writing his objections to this particular section of the code and address it to the commission (Radiation Protection) and the State Commissioner of Health. We told him that the commission would take it under consideration and would advise him of their findings.

This meant that he was really sincere, and that he had to sit down and document the reason why he should not comply with this section of the regulations. If he did this, and it was sent in, the commission would call for his complete file, along with the recommendations of the chief of the X-ray section. In 99 percent of the cases, the commission backed the chief of the section, and a letter went out under the chairman of the commission's signature, advising the doctor that the commission had weighed and reviewed his case and felt as though his request for exemption should be denied.

**MR. GRAHAM:** In tennessee, our code does provide for variance to the code. Of course, the interested person has to request a variance to it, and in many instances, we have been able to grant exemptions. For example, in X-ray therapy, our code requires that they have interlocks on the doors. A doctor might say, "I see no reason to have an interlock, because they would have to run over me to get into the room." In instances like this, we have granted an exemption. I think it is well that a code have a provision so that the department can use judgment in granting variance to the code.

MR. ROESSLER: A few years ago, only the radical talked about compliance, yet today everybody is talking about it. This reflects a change in the attitude of these programs that I have detected all through this meeting. I don't like the term "compliance" too well, because it is so final. All deficiencies carry equal weight. Several years ago, we were working with the concept of graded importance of deficiencies. There were certain items that were serious; there were certain items that were less serious, and our "compliance" approach was graded in toughness correspondingly.

MR. BRITAIN: Bill, if a physician refuses to bring his machine into compliance and says, "I will just quit using it," would you want some kind of proof? The tube head maybe?

MR. GRAHAM: We take their word. In the inspection, we ask them questions, and we take their word for that. They ask for a license to use radioactive material, and they tell us what they have, and we take their word. We don't go out and make a pre-licensing inspection.

MR. ROBISON: We have had them take as long as six months to come into compliance. But we have never gone to court. Our regulation requires, if an X-ray machine is not to be used, it will be tagged for nonoperation, and this is what we offer to do before we try anything else, and we have never had to go past that yet.

MR. PAYNE: I would like to take one final blast at compliance in urging that the Center seriously consider Marshall Little's suggestion that the term be better defined and that we come up with a set of guidelines which will give at least the Center a framework within which to operate. So that when we see the term "compliance," whether it be in a report or table or what have you, at least we will have a general idea what is meant. This could probably be of help to some of the States or other organizations who may want to go by these same guidelines.

# SURVEY INSTRUMENTS AND SPECIAL DEVICES

Charles E. Roessler, Ph.D.[1]

As we have heard these two days at the meeting, X-ray surveys have been made for a number of years. A variety of instruments and devices, both commercial models and special designs, have been used. The list of the equipment in the standard PHS kit may be found in the PHS X-ray Survey Training Manual, or on page 66 of Report No. PHS-999-RH-8 of the "Environmental Health Series."

The Nucor Cutie Pie survey meter contained in that kit can be used in the rate meter mode only. These survey meters are used to measure operator exposure and secondary radiation. One important feature to consider in selecting a survey meter is the time constant or response time of the instrument as compared to the length of exposure time in the normal operation of the X-ray machine. A Nuclear-Chicago Cutie Pie was mentioned by Mr. Carter yesterday. The early version of this survey meter had only the rate-meter mode; in later versions the integrating mode was added as well. Cutie Pie survey meters are also used for evaluating the effectiveness of the protective glass over the fluorescent screen in conventional fluoroscopes.

The second type of instrument in the survey kit, the Victoreen Condenser R-meter is used to measure output at the table top or in the beam, and to estimate the beam quality in order to infer the amount of filtration present. This is a very fine instrument and is perhaps too good an instrument to use for ordinary survey purposes; however, it was adopted for the early kit because it was commercially available and was recognized by health physicists, radiation physicists, and radiologists alike, as an acceptable instrument for measuring radiation beams.

Fluorescent screens are used for determining size of the dental beam at the tip of the pointer cone and fluorescent strips are used to determine beam sizes from medical radiographic machines. A micrometer is used by some surveyors to determine the thickness of the accessible added filters. A block of lead is used to standardize the fluoroscope beam size and to block the ports in determining tube-head leakage. In 1960, the cost of the survey kit was listed as $1,331. Today, several hundred dollars additional would be needed to reproduce this kit because of the increase in the price of survey meters.

Photographic film is also utilized by some people in X-ray surveys. Yesterday, Mr. Carter mentioned using a film to determine beam size and alignment. Others use film to localize radiation leaks in tube heads or in special shields. Fluorescent strips have been an easy way of determining beam size in the days when we were talking about reducing "whole-wall" radiation to "whole-patient" radiation. However, as we deal in inches of beam we may find that strips or sheets of photographic film are more convenient to measure beams with this degree of accuracy.

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[1] University of Florida.

There have been a few new commercial developments aimed at a single instrument concept. For example, Nuclear-Chicago now supplies interchangeable ion chamber probes for use in both the mR and the R range; both of these probes can be operated in either the rate-meter or integrate modes. Another single instrument concept is the Victoreen 666 fluoroscopic survey meter which is a modification of the 444 survey meter using interchangeable R and mR range chambers. It is both a rate-meter and an integrating instrument. The time constant of 5 seconds is a little long for convenient use and the net instrument weight of 9 pounds is a disadvantage.

Discussion (entire group)

DR. ROESSLER: I would like to hear a description from the Georgia people of the kit they have assembled.

MR. KARP: First of all, we decided on the necessary instruments, and we went out to look for a brief case that would fit the instruments. The Nuclear Chicago was acceptable. We had a lot of problems with them to start with, as long as we used the manufacturer repair service. We started repairing these instruments ourselves, and the problems have been reduced greatly. Now, the best part about this instrument is that it is small and it is an integrated device. So this is good for taking HVL measurements, especially with the small chamber. We can run a HVL measurement on a fluoroscope and take a table-top measurement very simply. On HVL - we run a zero, a one and a three. This will give us a rough idea if the HVL is over or under two and a half mm of aluminum. Table-top exposure rate measurements are taken by tilting the instrument so the chamber touches the table. We check calibrate this instrument about once a month. To check calibrate, we take a Victoreen R chamber meter and set it next to the Nuclear-Chicago and cross-check them.

In making measurements, we usually take the highest kVp that the facility uses; mA is their standard mA. It will usually run three or three and a half mA. If it runs less than that, we use what they use.

MR. RUSSEY: I imagine our conventional fluoroscopic screen versus your image intensifier phosphor check out?

MR. KARP: Right, And for image intensification, we have a device here that will block the phosphor, because it is not wise to put the primary beam directly on the phosphor. We try to protect the image tube. We strap or tape the device on whatever the situation calls for. We use a spinning top or a timer check on the short-time ranges, such as twentieth of a second or tenth of a second. You place a film in a cassette underneath this top, spin the top and have an exposure made at whatever speed you like, a tenth of a second, a twentieth of a second or what have you.

DR. ROESSLER: Would you go into the theory behind the spinning top as a check on the timers?

MR. KARP: All the X-ray tubes work on 60 cycles, and, therefore, you will have 120 pulses per second. If it is a half-wave tube, you will have 60 pulses per second. This will tell us, if the timer is set at a tenth of a second, and it's a 120-pulses-per-second machine, that we should get 12 dots on the film. Now, if we don't get 12 dots, then there is something wrong with the machine. One thing important here, though, is that if you get a half of a dot at the beginning and a half a dot at the end, that's two dots. You have to count it as two in this particular case, because of the function of most of the timers and the machine set-ups.

MR. SEABRON: What are your accuracy limits on your timers? What limits are you considering good or bad?

MR. KARP: We tell them what the accuracy of their timer is. Actually, another important service is that if one of their valve tubes is out, you will pick that up with this spinning top method, because you will see a skip in your series.

MR. LITTLE: The important thing about timers is not whether or not they are accurate, but are they reproducing. If they are constantly wrong, then it's okay, but if they are one second one time and half a second another time, you have got troubles. Do you check out consistency on reproducibility?

MR. KARP: Yes, if you do three of these at different times, you will get a good idea of how consistent it is, because it is strictly electronic, and it is not going to vary that much.

MR. RUSSEY: How do you regulate the speed of the spinning top? Do you have different speeds for different exposure times? You use different speeds for different time settings in order to spread out or keep the dots from grouping too close together so it gives you a better count.

MR. KARP: Speed really doesn't make too much difference. If you can get a reasonable rate, the dots will be separated. Even if the dots overlap, you can pick them out.

DR. ROESSLER: Do you check the darkroom technique and the developing process?

MR. KARP: We do. We don't tell them we are checking the darkroom technique or process. We just tell them to develop the film. We watch the timer, what he does in the room, and so on. You can tell if the darkroom developer is cold. You can tell if they are developing by sight by the time it takes them to develop.

MR. BRITAIN: Just how many timers are you finding not in good shape, say, 5 or 10 percent out of calibration?

MR. BRADBERRY: One in ten. But let me emphasize a point here. It is not the big hospitals where we are finding bad timers. It is in the smaller installations where it might be this high. It might be in the chiropractor's office or the physician's office, where so long as he has been able to get a picture, he hasn't really been worried about the time.

DR. MCDOWELL: How many are you finding that are deficient in reproducibility and accuracy?

MR. KARP: The number on that, I can't give you, but there are some. Some will be deficient in only one time period, such as a tenth of a second. We also have a device to check film screen contact. We lay screen wire on top of the cassette and make an exposure of about five mAs and about 50 kV (use the lowest kV you can). You will be able to see light leaks in the cassette and also artifacts. You can see where the screen is not making good contact, because the image that comes out will be blurred wherever the contact is not good.

MR. GRAHAM: Why are you concerned with accuracy of the timer if they don't overexpose their people, if they get the film they want?

MR. KARP: A lot of times they don't get the film they want and they don't know why.

MR. GRAHAM: In other words, they are going by the technique chart.

DR. ROESSLER: Well, it's part of the old question, good technique usually produces good exposures and usually produces minimal exposure, and bad technique produces reexposure and less information.

DR. MCDOWELL: Do you record a size of the beam in all measurements, or do you merely determine if it is greater or less than 24 inches?

MR. KARP: We determine a beam size by calculation for every cone there, and we use the fluorescent strips as a check of our calculations. We also use a fluorescent strip crossarm for beam alignment. On our survey form, we list every beam size that a particular cone will produce at each distance used.

MR. PAYNE: Our next presentation will be made by Eddie Fuente who will speak to us on radiological health regulations.

## REGULATIONS

### Eddie S. Fuente[1]

Although we had an X-ray program in 1960, our first regulations were not established and adopted until June 1963. Our source of information at this time was Handbook 76, which some of the recommendations were taken from. This past year, we have gone through every revision to our rules and regulations covering medical and dental X-ray. I feel they are comparable to the regulations governing medical and dental X-ray that the States in this region have adopted.

I would like to tell you of a comment or two that we got from our Radiation Advisory Committee. Our Radiation Advisory Committee consists of three radiologists. One of the radiologists stated that, regarding our proposed revisions, in general, he had a negative response to these and was opposed to regulations as a whole. He felt that eventually the revisions would be too restrictive and would be a hindrance to the medical user of X-ray units. However, he then stated that as a member of the Radiation Advisory Committee, he would concur with any State regulations that were established. But they objected to some of the wording as to whether you should use "shall" or "should" in some of the regulations. Another radiologist expressed opposition to our apparent shift in philosophy of our unit regarding enforcement of the regulations pertaining to X-ray.

As sources of information for our revision this past year, we selected the regulations of several States in this region. We reviewed these regulations which applied to medical and dental X-ray and used them as a source of information. In addition, we used Handbook 76 and the Council of State Governments' suggested regulations. All we did was take some of the recommendations and add them to ours. Particular attention was directed to the regulations issued by those States adjacent to Mississippi in order to maintain greater consistency and compatibility between State radiation control programs.

Discussion (entire group)

MR. LITTLE: I wanted to mention the fact that the Council of State Governments has come out with a new model guide dated June 1968. So it should be available very shortly.

MR. FUENTE: At the time of our revision, this was not available, so we may have to compare the recommendations in Handbook Number 33 to our regulations as they stand now. We may have to make some adjustments there. But the updating of regulations is getting to be a factor where you may have to amend or revise on an annual basis. I hope we don't have to go to this.

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[1] Supervisor, Radiological Health Unit, Mississippi Board of Health.

**MR. KARP:** One important objection I have to this suggestion for State regulations is that it's full of "shoulds," and, to me, a "should" doesn't belong in a regulation. A "should" is a rule of good practice and it belongs in guidelines. A regulation must be able to be checked, and you can't check a "should." It really has no meaning.

**MR. FRY:** I will take difference to this, because we put "shoulds" in. Over a period of time, many of these "shoulds" work their way into "shalls" as recommendations are changed. I think a good example right now is the recommendation for use of gonadal shields, which we regularly recommend. I think we will see, in the next year or two, that they will be required.

**MR. SEABRON:** Remember now, these are the model regulations. The "shoulds" that were put in there were put in there to give you latitude to make them "shalls," if you wanted to make them "shalls." If you don't want to change that word to "shall," then you'd better eliminate it completely.

**MR. FRY:** I think it would be well to bring out for clarity that if you read the definition of "should," it's an awfully strong definition; it is more than a casual comment. It's a pretty strong recommendation of something to do.

**MR. WILLIAMS:** We just went through this with a lawyer, and in his opinion, "should" is just not a regulation. It should not be in there. It has no legal weight whatsoever.

**MR. COWAN:** It seems to me that, if you like the "should" provision, all you have to do in your own State regulations is make it a "shall." Over the past 3 years, we found that by the large the regulations in Alabama have been acceptable to the people whom they are imposed on. We have found only two items that have given us any trouble at all. I would like to bring these to your attention. One is the requirement of interlocks for a superficial therapy unit or a therapy unit that operates at 60 kVp or below. This may have been changed in a later amendment to the Council of State Governments, but this gave us an awful lot of trouble. I think if we really analyze the rationale for this trouble, we will almost conclude this is not necessary.

The other item that gave us considerable difficulty - and I mean by this, it really wasn't very acceptable to the radiologists - was the requirement of a cumulative timer on a fluoroscopic unit. The radiologists don't like this particularly. I think they will go along with us, just condescend, if we push it, but they don't think it is worthwhile. Here again, I really wonder of what value this particular requirement is, because we must recognize the fact that it does not limit the exposure in any way. After 5 minutes a bell sounds or the X-ray machine is cut off. But all the radiologist has to do is reset it.

**DR. COLE:** I think it is better to have a warning device. Now, when you are doing a special procedure like cardiac catheterization, time passes fast, and to have a machine that would cut off at a critical time doesn't make good sense. So a warning device, in my mind, is the instrument of choice.

**MR. LITTLE:** I agree with that idea of a warning device, but it should always be tied in with the electronics of the X-ray tube so that the warning sound will continue to sound until it is reset. If it is just a timer that is not connected with the X-ray machine, it is going to get put in a closet and never used.

**MR. PAYNE:** Our next presentation is by Chuck Froom on the present and future status of National Center for Radiological Health training courses. You will then have the opportunity to give Chuck any recommendations you feel would improve these courses.

# BUREAU OF RADIOLOGICAL HEALTH[1] TRAINING COURSES

Charles P. Froom, M.S.[2]

Most of you know about our 2-week medical X-ray protection course. Later, I want to discuss some of the changes that we have made in this course and some of the proposed changes that we are intending to make in the future.

A course that you may not be familiar with, because it has been presented only a few times, is Introduction to Medical X-ray Protection. This course has been developed for two groups: (1) State and local health department personnel; and (2) for some military groups, specifically the Air Force and the Army. This is a course mainly covering surveys. We have tried to go over the practical aspects of X-ray protection and keep the theory to a minimum.

One area that we have heard a great deal about is that of training for X-ray technicians. Several courses have been held in this region for X-ray technicians. There is a 5-day course on Radiological Health for X-ray Technologists. This has been given in cooperation with the States, for example, one has been given in Jackson, Mississippi. These courses are designed specifically for instructors and supervisors of X-ray technicians. We hope that by working with these groups, information can be taken back and utilized in their own X-ray training programs and also in the supervision of X-ray technicians.

We also have an abbreviated course for this group - Introduction to Radiological Health for X-ray Technologists. This is usually a 1- to 3-day course. We try to cover just the minimum essentials that X-ray technicians really need to know to reduce radiation exposure. This course is given in the field for situations where the technicians are not available to attend the full 5-day course.

One other type of training for X-ray technicians is the 1- to 5-hour programs. Requests for these have increased tremendously throughout the country in the last couple of years. They may be presented at annual meetings of the X-ray technician societies - national, State or local meetings - and from 50 to several hundred people attend these programs. It is hard to determine the actual value of this type of approach, but it is a means of reaching large numbers of people with the hope that there is some benefit derived. In this area of X-ray technician training, it would be good for the States to become involved even more. For example, Jefferson County has developed a program for training their X-ray technicians. Georgia has an extensive X-ray technician training program. I am sure that there are many other States in addition to those we have worked with that have their own training programs for technicians. This area has expanded a great deal in the past few years. For example, this fall, in a period of about 2 months, we have scheduled five 1-week courses for X-ray technicians. We certainly welcome the States getting involved more and more in this area.

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[1] Formerly National Center for Radiological Health.

[2] Training and Manpower Development Program, Bureau of Radiological Health, U.S. Public Health Service.

In the area of dentistry, we do have a course on the fundamentals of dental radiation protection. This is a 1-day course for dental health personnel. It has been mainly dentists who have been involved in this course in the past. Seminars for dentists, which are only 2- to 3-hour programs, have been developed in cooperation with the State and local health departments and the local dental societies. These programs have been planned and developed by the Radiation Machines and Applications Branch of the Division of Medical Radiation Exposure, and we have assisted them in the presentation of these programs.

One final group of courses that we have given is the advanced X-ray series. In these courses, a specific topic in X-ray protection is studied and developed in depth. Some of the topics we have discussed so far include X-ray film and film processing, X-ray shielding design, polaroid film in radiography, measurement of X-rays, and the history and development of X-ray equipment. These courses usually last from 1 to 3 days, and we bring in experts in the field, such as Dale Trout and others with specific experience who can help greatly in the course presentation.

I would now like to mention our medical X-ray protection course which has been changed from a 1- to 2-week course. This was done mainly with the idea that we could get away from requiring the basic radiological health course. I think many of the States have people in their X-ray protection program who may not have a need for a breadth of experience or training in all fields, but will be working mainly in the X-ray protection program. Only enough basic material is included to give students the background they need to understand the topics discussed in X-ray protection. One thing that we have stressed particularly since switching to the 2-week course is practice in the conduct of X-ray surveys. By having this course over a 2-week period, we find that we can include more time for surveys. We have gone more into theory and provided a little more depth in X-ray protection than we did previously.

Over the years, we have added many new topics to our course. A lot of the changes are based upon critiques that we get from the trainees. They are also based upon meetings such as this, which are extremely valuable to us in getting feedback to determine what stage the States are in in their X-ray survey programs. One example is the topic of film-processing, which has been added to the course as we became convinced of the significance of this in reducing radiation exposure.

Some of these topics that we will add are not specifically on X-ray protection. For example, we will add something based on the congressional hearings that have been held in the area of nonionizing radiation protection *e.g.*, lasers and microwaves. We have discussed the possibility of adding something on color television. This is something that we would ask people from the Electronics Products Radiation Laboratory to lecture on and perhaps give a brief demonstration of their method of doing surveys of color television receivers.

We are presently planning on developing a phased system of building student survey competence. To start, we are planning to spend more time on the use of survey instrumentation. At one time, we had a special laboratory on the condenser R meters and some of the survey instruments, but later we dropped it. We are going back to that and will also add a special discussion of survey kits so that State people will have an opportunity to discuss their survey instrumentation. We can also demonstrate what we use and let the trainees become familiar with it before they actually get into the laboratory. Secondly, we plan a brief demonstration of the method of conducting a survey. We approximate that this would take 25 or 30 minutes. Following this, we plan to go into a guided survey in which the trainee will actually do a survey. The instructor will be there to give him guidance and also to discuss some of the concepts of doing a survey. Finally, we plan to set aside a day for the trainee to conduct surveys completely by himself and do a write-up to be turned in and discussed later.

There is one other area in training of X-ray technicians. The Southeastern Radiological Health Laboratory last year held a training course for X-ray technicians, including teaching techniques. They allotted one day to training in radiological health and the remainder of the time was spent on teaching techniques by the staff of the Communicable Disease Center.

Discussion (entire group)

MR. CALLIS: The people involved in this course seemed quite satisfied when they left in terms of receiving information on presenting lectures and incorporating radiological health and safety practices along with their lectures. We are hoping to do the same thing here in Atlanta probably in November of this year. This one will incorporate a little more radiological health, possibly still keeping about the same amount of teaching techniques in the course.

MR. GRAHAM: Chuck, do you have any plans for assisting States in developing their own training programs?

MR. FROOM: Yes, we certainly are willing to help any time we can in developing your programs.

MR. LITTLE: Chuck, in reference to the future training activities, what do you propose for the physicians? I know that they have tried to give 1-day courses and things like that, and apparently, it has been thrown out. What are the reasons for lack of success?

**MR. FROOM:** At one time, we had a 2-week course for physicians, "Medical Aspects of Radiological Health," but there just weren't enough applicants for this type of course.

We have given a 1-week course in X-ray protection for physicians including radiologists, for example, in Puerto Rico. I'm not sure if there would be enough interest in the continental United States to develop courses specifically for these people, but certainly, we are willing to develop courses if the physicians will attend. Perhaps we could develop half-day programs working with local medical societies. Some of the States, e.g., Arkansas, had a Statewide program of short X-ray protection programs for physicians.

**DR. MILLER:** These were given at the district medical society and were similar to the dental seminars. They were about 4 hours in length and covered the biological effects, methods of reducing radiation exposure in medical practice and the items covered in a survey of an X-ray installation. The State personnel usually give a description of the State regulations and the State program. These were attended by approximately 10 percent, I believe, of the physicians in the State. In some places, we had one or two, and in some places, we had 40 to 50 attendees at these seminars.

**MR. PAYNE:** Now, we come to the final, and in some ways, I think, the most significant part of our program, future State X-ray programs, objectives and components. Now, I have asked Henry Karp and Bob Britain to handle this part of the program for us, fully appreciating that it was a rather difficult assignment.

## FUTURE STATE X-RAY PROGRAMS

Henry Karp, M.R.H.[1]

I am going to talk about the educational program that we have, and maybe get some of your comments. I will be referring to some of the material in the package you all received yesterday. You will find a flow chart which describes our educational program.

In all X-ray schools of any size, we give a 6-hour course every year. That's about 15 schools. We don't have anything to do with one of these items listed, the Student Seminar, but the Atlanta Society of X-ray Technicians, every 2 years, puts on an excellent program, a 3-day program, for student technicians. You have a copy of the agenda for the last meeting. If you look through that, you will find that it is excellent. We need more of this in all the societies. They had 340 attendees at this meeting who came from all over the country. These students paid their own way. We would like to see this continued, and we would like to work with them as much as possible. But this handles only the student technicians. They give it every other year. So what I would like to try to do is, on the years that they don't give this, work with these same people and set up a program for registered technicians and go through this same gamut.

One of the more significant things that I hope works out is with the vets. We are planning with the University of Georgia Vet School to set up courses for veterinarians to come back and take refresher courses in radiology techniques. We are also planning, if Dr. Barrett can get the money, to put on a program for vets on educational TV. He is willing to do this and we are willing to help him in any way we can. If this works out, I think this would be a wonderful idea for the medical people to do the same thing. So we are going to use this as a pilot study to see if educational TV can be used in this particular way.

### Discussion (entire group)

DR. ROESSLER: Many of these medical groups actually assign points in some sort of a continuing education program. If you can get the head people to go along with this idea of putting it on their advanced education curriculum and assign points for this sort of thing, maybe you would encourage the people to attend.

MR. WILLIAMS: Is there any resistance to your program from the radiologists? Do they think that you're doing something that you shouldn't be doing with their technicians, or do they encourage this?

MR. KARP: They request these seminars and they even sit in with us.

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[1] Chief, X-ray Control Section, Radiological Health Service, Georgia Department of Public Health.

**MR. WILLIAMS:** Are they, on the other hand, sending the students?

**MR. KARP:** We go to their schools and it amounts to 2 hours a day once a week for 3 weeks. Then we will try to cover it in 2 or 3 days in succession if the school is some distance away.

**MR. PAYNE:** You mentioned your relationship with the radiological society.

**MR. KARP:** We have letters from them, and they actively support us in anything in the educational line that we want to do. This fall we hope to put on an instructor training course which Bob Callis mentioned earlier. Now, if we can get these instructors trained to the extent that they can handle radiation safety the way we would like them to, we can eliminate this 6-hour course. Then we can concentrate our effort on the people that have just had on-the-job training, and this we will do regionally by giving a 3-hour course.

We've also worked with the dentists. Emory Dental School has expanded its program to where it has a course now that runs for a full year, and it meets once a week. The course includes radiology, radiation protection, film techniques, diagnosis, etc.

# FUTURE STATE X-RAY PROGRAMS

Robert G. Britain, M.S.[1]

I would like to begin by making a comment on two types of surveys or inspections that have been discussed these past 2 days. The first is the Georgia approach, heavy on education, where the inspectors may spend 3 or 4 hours at a facility. The second is the "equipment survey" with a small amount of education and possibly taking up to an hour per facility.

I think both types of surveys have their place. Georgia is using this approach because they don't have regulations, and they usually have to be invited to perform the survey. Unfortunately, as Mr. Karp stated earlier, it will take Georgia about 10 years to see all their facilities.

States with regulations should strive to bring their X-ray units into compliance as soon as possible. I say this for two reasons. Defective equipment is a large contributor to unnecessary radiation exposure, and in the majority of facilities with defective equipment, the operators are usually short-term and will probably never attend a short course in radiation safety.

Now what about future State X-ray programs. I can tell you what one State, North Carolina, is planning to do. We are still in the midst of our initial surveys, but we realize something more has to be done than just surveys. We realize the need for more and better trained operators of X-ray equipment. Our problem, of course, was how to improve this area, yet maintain a reasonably efficient inspection program. We took our problem to the Research Triangle Institute in North Carolina to see if they would research this area for us and propose a plan of action. They were interested and submitted an initial proposal which I am going to read to you. They have entitled this "Some Ideas and Assessment of Training, Licensing and Job Opportunities for X-ray Technicians."

There are essentially two types of X-ray technicians; those trained for office procedures by physicians and dentists, and those trained in formal curricula as X-ray technologists. It has been pointed out that, where the X-ray technician has received on-the-job training in the offices of physicians and dentists, there is probably a considerable gap between the technology being employed and the best practices that could be used to protect the populace of the State from harmful effects of X-rays. One of the problems, it appears, is that X-ray technicians trained by physicians or dentists in their private offices have to meet no formal educational requirements before the public is exposed to attempts at a rather advanced technology. Indeed, many of the technicians may be trained on the job by physicians or dentists who themselves have inadequate training and education in the field of X-ray technology.

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[1] Division of Medical Radiation Exposure, Bureau of Radiological Health, U.S. Public Health Service (formally PHS Assignee to North Carolina).

Another problem is that the turnover in X-ray technicians is very rapid, which fosters the practice of training technicians on the job so that someone will be available to assist the physicians and dentists in this activity. X-ray technicians could be trained in community colleges and technical institutes throughout the State, but there may be a problem in getting students to enroll in such curricula, since job opportunities in the field may be somewhat limited.

To further complicate the situation, there are no formal tests or evaluations which must be met by X-ray technicians before they are permitted to practice within the State of North Carolina. This is a result of there being no licensing requirement for technicians within this State. It may be true, of course, that medical and dental facilities will employ only technologists who are included in the American Registry of X-ray Technologists, an organization which attempts to assure proficiency in its registered members, but this is not a formal requirement of North Carolina, and there is no guarantee of public protection in this regard.

In order to properly assess these problems, it is suggested that the Research Triangle Institute investigate the impact that various programs designed to improve the competence of X-ray technicians might have upon the entire field of X-ray technology within the State of North Carolina. Evaluation of procedures and programs available in other places throughout the country will probably shed light on various aspects of this problem. It is therefore suggested that the following be accomplished in order to reach an informed position on this matter:

1. Investigate the curricula currently available for training X-ray technicians in community colleges and technical institutes.

2. Investigate the techniques used to train X-ray technicians on the job in hospitals and medical schools throughout the State.

3. Evaluate the job opportunities, including wages and positions available in organizations such as the State Health Department, hospitals, industries, clinics and laboratories, in the State of North Carolina.

4. Assess the training programs used to prepare technicians for licensing in other States, such as New York.

5. Assess the education in the field of radiation health given to physicians and dentists in schools throughout the State.

6. Qualitatively review the impact of various combinations of educational and licensing programs on the availability of X-ray technicians within the State of North Carolina.

This evaluation would probably best be carried out by interview with X-ray technicians in major hospitals, and with physicians and dentists throughout the State. It would also be advisable to interview a few people in the administrative arm of various organizations, since they are often responsible for specifying the requirements for hiring people in their respective organizations. The range of interviews would not have to cover a very large number of people, but should be distributed in a fairly wide geographical pattern. It is suggested that technicians and physicians in charge of the X-ray units of at least one hospital, and the administrators in charge of employment in these hospitals in each of the following cities should be interviewed: Wilmington, New Bern, Raleigh, Durham, Chapel Hill, Winston-Salem, Charlotte, and Asheville. In addition, at least one dentist should be interviewed in each of these cities. The interviews should be structured to receive answers from a very limited number of questions primarily aimed at the following:

1. Current salary available to X-ray technicians.

2. Whether formal training as an X-ray technician would make the technician more valuable to the institution.

3. What opportunities exist for growth of an individual in this field.

4. What is the reaction to a licensing procedure by the State.

5. What is the experience with the competence of people generally applying for a position as an X-ray technician.

6. What other organizations employ X-ray technicians and what is the job market for these individuals.

In addition to the above suggested interviews, it would be desirable to see what positions are available for X-ray technicians in other States. Since the State of New York has a licensing procedure for X-ray technicians, there is a good chance that they also have some record of employment of these individuals. It would at least be worth the effort of inquiring to see if data of this sort are readily available. Also, the American Registry of X-ray Technologists should be contacted to determine what information exists in this organization with regard to job opportunity information.

Some contact should also be made with the American Public Health Association, since they may have developed licensing-type examinations for X-ray technicians. If this is the case, they may also have suggestions as to formal training that should be given current and prospective practitioners in this field.

This is a brief outline of some of the things that might be looked at in surveying the situation, with regard to producing and employing competent individuals for serving the public in a potentially hazardous technology. The ultimate results of the investigation would be:

1. An outline of various courses of action that could be taken for producing competent technicians.

2. Possible means for keeping these individuals in positions where maximum benefit would accrue to the public.

Discussion (entire group)

MR. WILLIAMS: I missed a point maybe, but who is going to pay for this investigation?

MR. BRITAIN: That hasn't been decided yet. But these are the practical investigations that are being looked on favorably these days. I think there is a need for something like this. In North Carolina, we don't have time to perform this task ourselves.

MR. LITTLE: Maybe I don't speak for the group, but from the ones that I have talked with privately, I would say that everybody is pretty much in agreement that there is definitely a need for it.

MR. BRITAIN: Does any State here really have a plan as to what the best course of action is?

MR. LITTLE: I think the tendency is to either go ahead with licensure without making an investigation, or do nothing, but I believe this is a much better approach.

DR. MCDOWELL: How many States in the group currently have movements under way within their particular localities that you might consider would be leading toward technician licensure? (Several hands were raised.) So essentially, I might turn it around; how many do not have movement in this direction? (Several hands were raised.)

MR. BRITAIN: Would this include all X-ray operators?

DR. MCDOWELL: Well, I'm thinking specifically of something similar to the New York law which would set up technician categories such as a general-purpose license versus single purpose chest radiography. An individual operating a dental unit with the beam diameter restricted to 3 inches would not be required to have the same 2-year accredited schooling that would be required for somebody doing multiprocedures. I might ask another question, then: How many State program directors here are in favor of technician licensing? (Several hands were raised.)

MR. FETZ: We could support it, but we can't promote it.

DR. MCDOWELL: I say, "in favor of it." That doesn't mean you have to go out and promote it.

MR. WILLIS: You're assuming this is a mechanism in which to upgrade them. I don't think this is the only mechanism by which it can be done. This is one mechanism, and this is the legalistic approach.

MR. BRITAIN: This is more to eliminate the unqualified, not to upgrade the already proficient.

MR. WILLIS: This is true. You're upgrading as a whole. You're establishing a minimum, in other words.

DR. MCDOWELL: A statement of minimum standards of qualifications for operators.

MR. WILLIAMS: I think this is a negative-type statement, but it has been said many times before, that you have ~~got~~ to look at what happens to nurses when you upgrade them. Nobody can afford them any more. I think minimum standards, yes, but not licensing.

DR. MCDOWELL: How would you achieve minimal standards?

MR. WILLIS: Well, you get into another area here. In the first place, we usually say we are going to impose this upon them. This is a little contrary to what is normally done on licensing. Usually the group approaches a State agency or State legislature and asks to establish a licensing board for the group. This, I believe, is what was done in New York.

DR. MILLER: In most States, you have to pass an examination to prove that you know how to operate an automobile and then that you know what the State laws are regarding its use. Something on this order could be used in X-ray.

MR. WILLIS: This is a general licensure versus a professional licensure, and I think it is the difference here.

MR. FRY: In Kentucky, a bill is being drafted by the State Technicians Society. Now, I will admit, we are giving them impetus, encouragement, but it is their project, and we have purposely kept our hands off it so it will not be called the Board of Health law that says, "Now we are going to regulate you people." They are equally interested in the high quality of X-ray technicians. They are concerned that it be limited to their high quality standards but it provides a very little to help raise the standards of the "button pushers."

MR. BRITAIN: Dick, would this affect all the X-ray button pushers in Kentucky?

**MR. FRY:** I haven't seen it, but my understanding is that what they want is everybody to meet the RT standards.

**MR. BROWN:** Not to change the subject, but going back to the document that you read, I think we have all seen pretty readily the value of incorporating education into our survey programs, and I certainly agree. My only concern is that in North Carolina, we are not able to do a whole lot of this. I would like to be able to do as much as, say, Kentucky is doing. On the other hand, I look at incorporating education into the survey on individual users of radiation as a perpetual problem. Our major objective in this document is really to get to the place where I don't have to worry about telling an individual physician, dentist or technician all about radiological health, radiation safety, and I don't know of many places that are really doing anything to get at the root of the problem where the physician, where the dentist and where the technicians are being turned out. If we could get into the educational institutions and get, maybe not a formal course in radiological health, but just a general attitude toward radiological health, it would be a step in the right direction. As I see it now, if we don't improve the education of these people in radiological health, we are forever going to have to worry about seeing everybody individually and trying to get him to change his way of thinking, which is a very inefficient task.

**MR. KARP:** Like I said, we are with the vets, we are with the dentists in Georgia, and we are with Emory Dental School, and in a way, with the University of Georgia, since one of the members of the Control Council is at the University of Georgia.

**MR. BROWN:** Do you have any suggestions for how I might accomplish such ends personally in North Carolina? Most of the education goes on in the hospitals and most of the big schools also fall out from under my jurisdiction.

**MR. KARP:** If you get to know them personally, then you can work with them. Now, we got to know the vets by helping them design shielding, helping them design therapy rooms and such as this. Gradually, it progressed, and in about 2 years' time, we were working well together. Just by knowing the people at the dental school, we have got them to increase time spent in radiology in their curriculum.

**MR. FETZ:** The chairman of the Department of Radiology at the University Medical School is the chairman of our Advisory Committee, and I asked him a number of years ago what type of program he presented to his radiology residents the first time he saw them. He told me and I recommended that the first lecture be on radiation safety, and he finally decided this made some sense. Now, his first lecture is on the weapon that the doctor either uses or has under his control. He has been converted. That's a good way to break the chain if we can get all the chairmen to do this. If the dental radiologist gets to the dental student the first time out of the books and tells him that a dental machine is a dangerous toy, if we can orient the super technician or the teaching technician with a radiation safety lecture right off the bat, we will break this chain eventually.

MR. KARP: One question we haven't answered is where are we going from here, as far as physical surveys are concerned? Are we going to do the same thing 10 years from now that we did today? Now there is more emphasis on education while earlier it was strictly an evaluation of the physical plant. I have heard from some radiologists that sometime in the future, technicians may be doing fluoroscopy on some of the more elaborate equipment. Another thing we are finding is three-phase machines. Timers on a three-phase machine are different than on single-phase machines. A spinning top doesn't work. We have got to design a new method of checking timers on a three-phase machine.

MR. LUBENAU: I would like to toss out a comment that Tom Gerusky has already written to many of the State program directors about, and this is something in the line of future needs. We need a mechanism for exchanging information quickly, efficiently and inexpensively, not only in terms of program direction, but in the nitty-gritties, like the development of a new timer on three-phase machines. I don't know how this can be done. We have been attempting it to a very limited degree by simply informally sending some documents that we prepared to other State radiological health program directors. I wonder, perhaps, if there is a need for informal publication systems, something that does not have to go through the formal review procedures within the State and then through the editorial system that might be the case, for example, of Radiological Health Data and Reports.

MR. BRITAIN: Just one more comment before we break. We are going to have a lot of old X-ray equipment for many years, and I think some of our future surveys should be directed at improving the use of this equipment. For instance, let's take the dental office. Dick Fry tells me he is pushing fast films. We are in North Carolina thinking about pushing open cones and lap aprons, as well as fast film. If you have got the proper collimator and filter, open lead-lined cone, lap apron and fast film, you have almost got the problem solved. Any comments on that?

MR. KARP: Why the open cone?

MR. BRITAIN: There is less scattered radiation to the patient and to the operator.

MR. LITTLE: Also better quality.

**MR. PAYNE:** Are there any final comments or any overall impressions you may have of this meeting or anything of particular significance which was discussed during the meeting that you would like to reiterate or single out again?

**DR. MCDOWELL:** For your information, the proceedings of this meeting will be edited, and a document will be prepared and will be distributed not only to the people within the group, but to all the State program directors throughout the country.

**MR. PAYNE:** We certainly appreciate your participation, and as far as I am concerned, I think this meeting was quite constructive. I personally learned a lot. I have never before experienced such an intensive discussion of X-ray programming. Certainly, the conclusions that this group have come up with and the comments that have been made, I think, are just as impressive as any that could be made by any group anywhere.

# APPENDIXES

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# APPENDIX A

## Resurveys in Jefferson County, Alabama
Jefferson County Department of Health
Birmingham, Alabama

### Definitions

Inspection of Equipment: Visual inspection usually done during installation or construction.
Re-inspection of Equipment: Follow-up on above after construction or installation is complete. Also, periodic inspections to determine continued compliance, etc.,
Complete Safety Surveys: Done initially on all installations, including radiation measurements and re-done when periodic inspection reveal the need.
Promotional Visits: To obtain and/or disseminate useful information in an informal way.

Resurveys would then be defined as any of the above except the initial determination of compliance or non-compliance. This initial determination may take place upon our first contact or after several visits and consultations.

Therefore, a resurvey, is an inspection or survey which is made to determine if compliance has been accomplished as per our recommendations or it is a survey to determine if compliance has been maintained since our last visit.

If in the initial survey the unit is not in compliance a letter is sent stipulating what corrections are necessary, etc., normally allowing 30 days for correction. At the expiration of the 30 day period a resurvey is conducted to determine if corrective measures have been successfully carried out. If not, another 15 days is allowed. If still not in compliance after this second time period we "offer" to tag the unit for non-service. This has only happened twice since our program has been in effect.

If the resurvey is to assure the maintenance of compliance then the survey is essentially a visual inspection, and the form entitled "Periodic Inspection Report" is used. This type of survey is usually scheduled on a "mass" basis, that is, we try to resurvey all units of a particular classification in a specified length of time.

In these surveys or resurveys we attempt to inspect hospitals once a year; clinics, private physicians, dentists, veterinarians, chiropractors and industrial installations once every two years. However, this is not generally possible because of the necessity of conducting complete initial surveys on new installations, approving plans and specifications, and other more pressing duties.

In evaluating the need for or value of periodic resurveys, whether it be to determine if recommendations were followed or merely to determine if compliance has been maintained I would like to present some of our past findings.

### Comparison Figures

| | Compliance 1st Visit | Compliance May 3, 1963 | Compliance Dec., 1963 |
|---|---|---|---|
| Private Physician - - - | 6.8% | 57.3% | 82% |
| Clinics - - - - - - - - - | 3.2% | 45.2% | 84.4% |
| Hospitals - - - - - - - - | 6.7% | 46.6% | 73.3% |
| Chiropractors - - - - - - | 0 % | 31.8% | 69.2% |
| Veterinarians - - - - - - | ? | ? | 55.5% |
| Dentists - - - - - - - - | 94.3% * | 98 % | 98.5% |
| Industry - - - - - - - - | ? | ? | 90 % |

* Includes modifications made at first visit.

As of March 31, 1968, we have a total of 717 X-ray units registered with 699 of these carried as in compliance. Of the 18 non-accounted for 13 are new installations which have not yet been surveyed and 5 are units which are tagged for non-operation. Therefore, for units surveyed, we feel that Jefferson County has essentially 100% compliance.

In addition, there have been 2 complete safety surveys conducted on all dental units in Jefferson County. The first survey in 1962, found that 108 out of 230 units inspected needed some modification.

The second survey, conducted during the summer of 1966, found that 148 out of 304 units needed modification.

At present, we are conducting a resurvey of all medical units. To date 3 out of 51 units surveyed (6%) have been found in non-compliance for some minor reason. Two of these had previously been certified as in compliance but changes made since our last visit accounted for the non-compliance at this survey. The third was a new installation unknown before to us and it along with the other two are in progress of being brought into complaince.

## APPENDIX B

## SELECTED COMPARISONS OF ALABAMA X-RAY SURVEY STATISTICS

### Medical Radiographic Units 1964 vs. 1966

| | 1964 Survey | | 1966 Survey | |
|---|---|---|---|---|
| Number Surveyed | 828 | | 854 | |
| Number Defective | 759 | 91.6%* | 525 | 61.5%** |
| Inadequate Filtration | 263 | 31.7% | 220 | 25.8% |
| Improper Collimation | 440 | 53.1% | 333 | 39.0% |
| Inadequate Timer | 15 | 1.8% | 9 | 1.05% |
| Inadequate Protective Devices | 81 | 9.7% | 19 | 2.2% |

*Includes centering device and improper alignment.
**Does not include centering device and improper alignment.

### Fluoroscopic Units

| | 1964 Survey | | 1966 Survey | |
|---|---|---|---|---|
| Number Surveyed | 430 | | 274 | |
| Number Defective | 231 | 53.7% | 204 | 74.5% |
| Excessive Roentgen Output | 35 | 8.1% | 29 | 10.6% |

### Dental Survey

| | 1963 Survey | 1968 Survey* |
|---|---|---|
| Number of Units Surveyed | 703 | 84 |
| Inadequate Filtration | 0%(1) | 18% |
| Inadequate Collimation | 0%(2) | 2.5% |
| Percent Noncompliance 1968 Survey | -- | 29% |

*1968 Survey Commenced April 1, 1968
(1) 100 percent in compliance at completion of survey.
(2) 100 percent in compliance at completion of survey.

### Hospital Survey

| | 1966 | | 1967 | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| Number Hospitals Surveyed | 121 | 100 | 121 | 100 |
| Facilities in Noncompliance, All Requirements* | 71 | 67 | 21 | 17 |
| Completion of Survey, Noncompliance, All Requirements | 10 | 8 | 4 | 3 |

*At time of survey.

## APPENDIX C

## GEORGIA MEDICAL X-RAY EDUCATION PROGRAM

### *TECHNICIANS*

- Survey instruction
- 6-hour course in schools
- Student seminars
- Instructor training course
- Talks to technical societies
- 3-hour regional seminars
- Teaching aids for schools
- Technician seminars

### *PROFESSIONALS*

**General Medical**

- Refresher course (tentatively planned)
- Educational TV refresher course (tentatively planned)
- Increase R.H. hours in medical schools (tentatively planned)

**Veterinarians**

- Survey instruction
- Publication - Georgia Veterinarian
- Expand radiology program in veterinarian curricula
- Refresher course at Univ. of Georgia (planned)
- Educational TV short course (planned)
- Society meetings (planned)

**Radiologists**

- Consultation
- Resident lectures at Emory Medical School

**Dentists**

- Survey instruction
- Expand radiology program at Emory
- Seminars
- Lectures for students at Emory Dental School
- Publication - G.D.A. Journal

**Radiological Physicists**

- Student seminars
- Course for R.P. students at Emory (1 quarter)
- Renew R.D. program at Emory (tentatively planned)
- Course for H.P. students at Georgia Tech. (1 day/wk. for 3 quarters)

**Pseudo - Medical**

- Survey instruction
- Society meetings
- 3-hour regional short courses